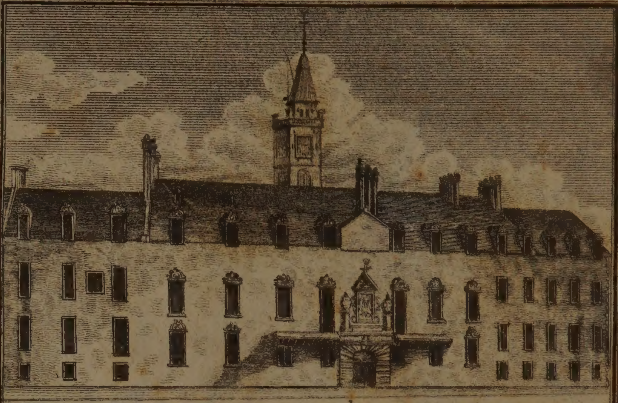

In Classe

Discipulus,

INGENIO AC LABORE

Insignis,

PRÆMIUM HOCCE

Meritò Consecutus Est,

Apud Coll. Glasg. } Thos Muir
1mo die Maii, }

Swan Sculpt

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H. VIII. Bel

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THE

PRINCIPLES OF SURGERY,

AS THEY RELATE TO

WOUNDS, ULCERS, FISTULÆ, ANEURISMS,
WOUNDED ARTERIES,
FRACTURES OF THE LIMBS, TUMORS,
THE OPERATIONS OF TREPAN AND LITHOTOMY.

ALSO OF

THE DUTIES

OF THE

MILITARY AND HOSPITAL SURGEON.

BY JOHN BELL.

A NEW EDITION,

WITH

COMMENTARIES AND A CRITICAL INQUIRY INTO THE PRACTICE OF SURGERY.

BY CHARLES BELL,

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IN [illegible] VOLUMES.

WITH ENGRAVINGS AND NUMEROUS ILLUSTRATIONS.

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BY CHARLES BELL,

PROFESSOR OF ANATOMY AND SURGERY TO THE ROYAL COLLEGE OF SURGEONS IN
LONDON, SURGEON OF THE MIDDLESEX HOSPITAL, ETC.

◆

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THE
PRINCIPLES OF SURGERY:

CONTAINING

THE HISTORY OF THE OPERATION OF LITHOTOMY, AND CRITICISMS ON THE DIFFERENT OPERATIONS.

PREFACE.

THE main purpose of this work is to connect anatomy with surgery; to remind the surgeon, already engaged in practice, of those parts of anatomy which he is so apt to forget; to submit to his review the history of operations, that he may make his election with the confidence of one who knows the sources of knowledge, and who reasons from the only sure principle, the structure of the parts diseased: how I conceived so bold a design, which looks like innovation, or presumed to think myself capable of so great a task, I shall now endeavour to explain.

To ally anatomy more closely with surgery, to connect the art more intimately with the science from which it flows, seemed to me a task as yet imperfectly accomplished, and yet of the very highest importance.—The study of pathology contributes not merely to make the surgeon intrepid, bold, and skilful, but to keep alive those sentiments which give a peculiar value to his best and most sacred duties. The continual reference of every symptom and suffering to certain physical changes going on within the body, begets a lively sensibility for the feelings of the patient while he lives, or to his fate when life is in danger. The frequent reasoning on those changes, produces a talent for observing the course of disease, and a calm, sober, and serious turn of mind, not unfavourable to prompt decision and manly readiness in circumstances of pressing danger. The surgeon who is skilled in prognostics, and familiar with the signs of danger; who is well persuaded of the necessary and urgent motives which engage him in difficult operations; who is conscious that he inflicts pain only to prevent long suffering, or endangers life only to preserve it, can know no taint of fear. Without this science to interest our feelings in every new scene of affliction, our profession would be coldly practised: without this study of causes, and a continual ambition to come to every new consultation, with new acquirements of knowledge, new precedents, and more decisive facts, professional men would languish in the pursuit of science: without this philosophical view of the parts and functions of the living body, practice is not experience, and gray hairs and length of years bespeak only stubbornness in prejudice, and ill-founded claims of deference and respect.

Experience is observation founded on previous knowledge: but to prepare the mind of a young man for receiving the lessons of experience, he must have the science so digested, and its principles so displayed by the teacher, as to perceive, in one view, the natural and healthy structure of parts, the changes produced by disease, the probable issue of those changes, and the remedies and operations by which ill consequences may be prevented. Such principles every man of real experience, founded on knowledge, treasures up, perhaps unconsciously, in his own mind. But his knowledge is the slow acquirement of years passed in doubts and perplexities: very rarely are the principles of science unfolded to the younger part of the profession, seldom is the surgeon sent abroad into the world with that fullness of knowledge or maturity of judgment, which he might be taught to derive from a knowledge of anatomy, combined with the experience of individuals, accumulating through ages.

The present mode of teaching anatomy tends little to excite this spirit of observation. He will have little sympathy with the pains or suffering of his patient, who does not reason on what is going on within the body, who does not watch incessantly the symptoms indicating change, whether towards health or disease; and feel more fears and anxieties than his patient can imagine, and see dangers of which his friends cannot be conscious. Such reasoning, repeated from day to day, is truly experience. The mind thus occupied in reasoning, not upon an abstract philosophical question, but on one which involves the fate of a fellow-creature, must be inspired with sentiments which they who know not our profession, nor the best motives which excite us to diligence, believe paralysed and deadened by frequent scenes of misery.

Anatomy, far from being taught for so noble and useful a purpose, is taught as a task of the memory, and its applications, various and interesting as they must be, remain still problematical. Anatomy is not made interesting to the pupil as the basis of our reasoning on disease, the rule of our prognostications the sole guide in operating: he is taught to know the parts and remember their names, and then he is dismissed from the school; and of this school we all are pupils, abandoned early in our career, left to learn, in the hurry of practice, the very principles of the science.

The anatomy of surgery differs widely from that taught in schools: it were better the young surgeon had no conception of the forms of parts, than such as must be corrected by sad experience; for the parts of the human body are presented on the table of the anatomist, not only in circumstances, but in forms, in which they can never at any after period appear to the surgeon. If the bones are demonstrated, they are not displayed clothed with their muscles, and connected by their periostæum with the surrounding parts: they are not represented as parts of a living system, nourished by vessels, and subject to changes and diseases analogous to those of the living body: these are conceptions which the surgeon attains by slow and painful experience, for his teacher aims only at making him know and remember processes, and grooves and holes, which to know, is of no importance, and to remember impossible. The practical surgeon indeed learns by experience the changes of which those apparently inanimate parts are susceptible; but while he is observing how tumors alternately rise and vanish, are produced by disease or cured by remedies; while he is learning to discuss the tumors, to cure the ulcers, to destroy the dead, and to support the living parts of a bone; while he is acquiring by experience all that he should have been taught, all that makes anatomy useful, he believes that he is forgetting anatomy, because he is forgetting a gothic and barbarous system of names, remembers no longer holes and hollows of no import, and is exchanging the pedantic lessons of the schools for a higher kind of knowledge.

It were better the surgeon had no conception of a hernia, an aneurism, a hydrocele, than what he obtains from demonstrations of the peritonæum, the abdominal ring, or the tunica vaginalis, or the humeral artery; for on the anatomist's table he sees those parts under forms, which, through all his professional career, he is doomed never to recognise again, but to look for them in vain, in all his own operations and those of his friends, and that too in the most critical exigencies, where they should serve as the mark and limit of the incisions.

The anatomist describes, for example, the ring or opening of the abdominal muscles, and naturally mentions that it is the opening through which, in inguinal hernia, the bowels are protruded; but what avails such a remark? there is no note taken of the various changes produced by this very protrusion, no additional description to connect this anatomy of the sound, with that of the diseased part; the pupil is not told that he is never to see, in the living body, the same display of a ring, fair, circular, and circumscribed, such as is exhibited in the dissection of the sound body; the surgeon feels no such ring in any operation, and doubts, and hesitates, expecting to recognize that circular opening which he thinks he knows so well, and has so often seen.

The anatomist, in his course of teaching, dissects the peritonæum, and describing that membrane, according to the method of Haller, with all its involutions, and all its connexions, the coats it forms for the viscera, and the ligaments by which it binds each in its place, and he concludes with saying, "this membrane, gentlemen, or a process of it, is protruded through the ring, wherever the bowels are protruded, and forms the herniary sac." But far different is the sac which appears to the surgeon in the time of operating, thickened by inflammation, rough and irregular, from adhesion, connected, or rather confounded with the surrounding parts, imperfectly seen through the incisions, and obscured with blood; it is altogether unlike the delicate peritonæum from which it takes its origin, and is no longer to be recognised as a process of that membrane! The surgeon finds nothing corresponding with the demonstrations he has seen, or the conceptions he has formed: anatomy, which he faithfully studied, that it might be his guide in such difficulties, serves only to bewilder and deceive.

The anatomist demonstrates, from his preparations or dissections, the course of the epigastric artery, compares its situation with that of either pillar of the ring, and calculates and conjectures how it may be avoided. He who never operated in hernia, projects rules for the surgeon, and inculcates them; and from his lectures such rules are transferred to books, and pass from age to age, for lessons as important as they are formal. But when these same pillars are no longer to be distinguished, the opening betwixt them dilated, and every vestige of this formal ring obliterated by frequent protrusions; when the descending bowels have pushed aside this artery, and a new order of parts is exhibited, unknown to the class demonstrator, defying all calculation and conjecture, what must be the confusion of the young unexperienced surgeon who foresees no such changes?

While anatomy is taught, only taught from dissection of the sound body! no description, no drawings, no plans, nor schemes of the parts subjoined to correct the first impressions, to express the new arrangements of parts which accident produces, to indicate the changes in form and texture produced by disease! the surgeon profits nothing by that science which contains all the principles of his art. In hernia, the cause of death is ascribed to the obstruction of the bowels, and nothing is described but the signs of strangulation; yet strangulation is not the cause of death! The obstruction of the intestinal canal is not the cause of death! The actual mortification of the bowel is not the cause of death! but that fever and inflammation of the abdomen, which affects the whole system, and which is fatal, before the incessant vomiting could exhaust the patient, or the actual gangrene destroy him. Yet we have no description of this inflamed state of the abdomen, it is not even noticed, while the signs, real and imaginary, of strangulation, are minutely detailed; we have no narrative of the symptoms which prognosticate life or death, and the surgeon is hardly aware of his patient's danger, when hiccup and other fatal signs appear.

In cases of hernia, the various degrees and characteristic marks of abdominal inflammation form the true grounds of our prognostics; the anatomy of the parts, in their altered condition, distended by frequent protrusion, and massed together by inflammation, is the rule of our incision; and yet we are referred to the old descriptions of the abdominal ring and peritoneal process, for those essential points of knowledge which are only to be attained either by frequent and careful observation while operating, or by dissections of diseased parts. These are things which can be described only by the practical surgeon, by the man who has often, with a lively interest, observed and noted down the perplexing changes which he has met with.

Whence do these perplexities arise? from the separate and independent state of two departments in science, which are essentially and closely allied. The professed anatomist sits in his chair of dignity, explaining the structure of parts, but with no reference to their condition in disease: he is no surgeon, he has not put his hand to the work, he has felt no difficulties, his hand has not trembled, nor his face blanched at the apprehension of danger; he has little interest in describing difficulties he has never known, in anticipating anxieties and dangers which belong not to his department; he is employed on higher and more splendid,—should I not say more fantastic subjects of speculation?—The surgeon again, who writes for the instruction of others, is often no anatomist, and accepts very gratefully the imperfect rules for operating prescribed by those who never touched the knife; and thus it happens that pathology, which should unite science with art, is a sort of neutral ground betwixt the two provinces of anatomy and surgery, little regarded on either hand. The young man, studying our profession, learns his surgery and anatomy apart; to reconcile his first conceptions of anatomy with the changes which he is called to observe in his practice of surgery, is a species of reasoning which accident sometimes invites him to cultivate. But acquirements depending thus on opportunity, on accident, on time, which few can spare, and on that incessant diligence which is so apt to flag in the toils of daily practice and needful gain, are often imperfect even in the end of life; and when by continued diligence, a man attains a competent degree of knowledge for the ordinary duties of this profession, the knowledge thus acquired enters into his experience as an individual, and constitutes his reputation while he lives; it is profitable and honourable to himself, and useful to his friends; but when he dies, it dies with him, and is not preserved for the improvement of science.

Pathology is at once the most useful and the most painful study: there is a sort of satisfaction in finding our conjectures confirmed, our errors corrected, our knowledge continually improved by frequent dissections; but the frequent dissection of dead bodies; the act of reasoning and reflecting on the various causes of our dissolution; the sight of the dead, and the recollection of their last struggles and sufferings; the slow lifting up of the cloth which veils the countenance of a deceased friend, casts a gloom over a mind seriously engaged in those duties. Yet so important is the duty of combining pathology with surgery, so essential is it to the sound doctrine and discipline of science, and to the perfection of our art, that I had rather publish to the world descriptions of diseased urethra, and swelled prostate, such as Hunter has delivered and represented in drawings, than be author of all the discoveries of the age in which he lived: I had rather give descriptions and drawings of the herniary sac, in its various stages of inflammation and adhesion, or point out any thing which might facilitate so eventful an operation as that for hernia, than discover the pereneal mysteries of the thymus or renal gland. I had rather announce a series of such important facts, than show myself the most ingenious among the dreamers of dreams; for of such materials is produced the knowledge the most essential to the perfection of our art and the good of our fellow-creatures.

When we reflect on the incorrectness of our senses, and the imperfection of memory, we are conscious that in a science important to mankind, nothing should be left to recollection! every impression of sense should be noted down the moment it is distinguished! and from time to time those descriptions of evanescent impressions should be revised and compared. We remember, for example, with lively feelings, a scene in nature, an interesting conversation, or the form and manners of a friend, and we think that of such a scene or of the terms of the conversation, or of the features and forms which have pleased us, we have the most lively recollections; but when we attempt to repeat the words, or trace the features with the pencil, when we would ascertain our conception and put it to the proof, our recollections vanish like a shadow or a dream! impressions, which we believed permanent and luminous, are quite obscure, and tantalize us with a sense of distinctness which we cannot realize. How dangerous this in matters of science! If it be presumptuous in a painter to draw a likeness from memory, what must it be for a surgeon to trust to recollection for those signs which are to warn him of approaching danger, or for those descriptions of disease, those marks of parts, which are to direct him in operating?

Habits of industry, which I know not whether to attribute to chance or design, have enabled me to compose, for my own use, the descriptions of disease, and plans of operations which I found wanting in books of surgery; and diligence is a talent in such low estimation, that it will not be thought presumptuous if I claim this kind of praise; neither will it be construed into affectation, if I declare that whatever excellence I have attained in my profession arises from mere diligence, from perseverance in study, and fidelity in observation. In the most ordinary duties, faithfully performed, I have ever found the best sources of useful knowledge: I never yet attended the poorest creature in an hospital, without taking an interest in his distresses, and usually a drawing of his disease; nor have I neglected, in private practice, to record and treasure up my opinions of my patient's case, my hopes, my successes, and my disappointments, more faithfully than I have recorded my fees. I have never, with unhallowed hand, attempted any dangerous operation unprepared, trusting to my general knowledge of anatomy, or experience in operating; but have set me down to consider seriously of every danger, to plan the relative situations of parts, to provide for every exigence, to recollect the course of the great nerves or arteries which were endangered in the dissection, and to imagine every possible alteration in their course or form. In every case of fractured skull, of strangulated hernia, or of inflammation of the abdomen, in every variety of diseases of the lungs, of the throat, or of the glands, I have marked, from hour to hour, the symptoms, have made drawings from every dissection, and have written down, at the moment of witnessing any interesting scene, the impressions it made upon me, and those characters of disease, and those signs of danger which are so evanescent. In every tumor of the neck or jaws, which needed to be dissected out, I have made new plans of the carotids and the accompanying nerves, marking the branches which were endangered in the operation. In every case of polypus I have drawn accurate plans of its relations to the palate and nostrils, to the bones or cavities of the nose or throat. In every fistula I have drawn schemes ascertaining the direction of the various passages, their relation to the external openings, to the diseased urethra, and to the stricture which caused the confusion of parts; and when I turn over those case books, so precious to myself, I cannot but hope to make them useful to others; for with these silent monitors I consult, and sometimes find my conjectures concerning the disease belied by experience, or my plans of operations corrected by disappointments! but always I feel my knowledge of my profession improving, and am consoled with the reflection of not having spent my years in indolence, nor claimed any degree of confidence to which I have not this title at least of diligence and labour.

Many things conspired to confirm me in this habit of diligence: I felt that an operation to be performed with confidence must be carefully planned; that to lose the best fruits of experience by a self-indulgence, by a lingering and idle humour, was unmanly; to think over every subject anew, seemed in so far as related to myself an endless toil, and unprofitable to that profession, to which I was publicly pledged, as a teacher and as an author. To think with accuracy, I found it necessary to think with my pen, or my pencil in my hand; with these I resolved, to my own satisfaction, every surgical problem, and soon found that my command of facts accumulated, that my general knowledge improved, that my resources were expanded, that no case occurred without having its precedents to serve as a rule for my conduct, without analogous facts to give it importance! and every time I renewed my plans of hernia, aneurism, or tumor, I was conscious of having more distinct views and bolder conceptions of my duties as a surgeon, and of gaining daily accessions of knowledge, which, without this faithful practice of studying every case, would have been stopped in their source.

Yet I do not deny that habits, useful in themselves, may have led me into faults very grievous to even the best disposed of my friends; my habit of reasoning on surgical questions, not by descriptions, but by diagrams, by appealing not in abstract reasoning to the imagination, but to the senses, by plans of the parts, may have led me into prolixity, repetitions, and pleonasms of every kind, and may have increased the bulk and price of this volume. But my conscience dictated to me, that in matters of life and death, accuracy could not be a fault; that in a work of science, splendour of execution, not ostentatious, but plainly useful, would not, with the lovers of science, be a sin unpardonable.

OF THE TALENTS REQUIRED IN AN OPERATOR.

While the science of pathology ascertains the changes produced by disease, prepares the young man for practice, and enables him to form a just conception, and a true prognostic in every case of danger; it is the study of anatomy, and the habit of dissecting with address, that fits him for operating. I am aware that few surgeons are destined to become operators, or have ever, from their first entering into the profession, felt any thing but horror at the sight of blood; yet, the talent of operating is desirable, as it implies a perfect knowledge of the structure of the human body, and a superior skill in all the ordinary duties of the profession: to acquire this talent (for it may be acquired) is a fair and laudable object of ambition, and carries the young surgeon into the most useful of all studies, that of dissection: to acquire this talent is not only honourable to himself, and satisfactory to his friends, but is almost essential to his own peace of mind: he knows not by what unexpected accidents he may be involved, unawares, in difficulties of this nature; how soon he may, through the interest of his friends, be charged with the care of a great hospital, and find occasions of laudable ambition opened to his view, and opportunities of being eminently useful to numbers of his fellow-creatures! his situation, in remote parts of the country, may require him to operate on the poor, and if engaged in foreign service, or in the colonies abroad, he may find himself involved in difficulties which will bear hard upon him. But the young surgeon who has made this department his study, is no sooner engaged in practice, than he becomes conscious of the superiority it gives him; he is able, with honour, to seize whatever opportunities present themselves, of promoting his own interest, or seeking reputation; and he feels himself performing, with alacrity and confidence, those higher duties which often cast a gloom over the minds of those less perfectly educated.

Of all the unhappy feelings which the duties of our profession entail upon us, none are more oppressive than those which precede any eventful operation. They naturally arise from the respect we must have for the life and health, the pains and sufferings of a fellow-creature, who commits himself into our hands with entire resignation. They are avowed by men above all affectation. "If," says Chesselden, "I have any reputation in this way, I have earned it dearly, for no one can endure more anxiety and sickness before an operation, yet, from the time I begin to operate, all uneasiness ceases." Chesselden, though above all competition in this line, a perfect anatomist and a bold operator, yet felt and acknowledged these compunctious visitings of nature; but if to those natural fears were joined the slightest doubt in the mind of the surgeon whether he could perform his duty, should we wonder to see his hand tremble? should we wonder to see him preparing for a public operation, with all the feelings of a criminal, and performing it under confusion, embarrassment, and visible concern? It is only a consciousness of being ignorant of anatomy, and unaccustomed with dissection, a fear or suspicion of some unknown and indefined danger, that perturbs the judgment, and unsteadies the hand, and makes a bad operator retire from such a scene, if he be at all successful, with an exultation of heart which he cannot conceal, and which proves but too plainly that he himself imputes his success to chance and good fortune.

Nothing should be left to chance where life is concerned; these feelings of anxiety so natural, so honourable to the man who confesses them, can be lessened only by a careful education, and especially by being perfectly familiar with anatomy. He surely will feel the most perfect composure of mind who is prepared for every operation, that is, for every dissection that may be performed upon the living body, by having frequently dissected the same parts in the dead. The young surgeon acquires, by frequent practice, a familiar acquaintance with the several parts, and a freedom in dissection, which makes dexterity a natural habit; he learns to compare the size, relation, and connexion, of the several glands, nerves, and arteries; and is so familiar with the external and visible forms which denote their place, that, before operating, he can put his finger on a part, and say whether any danger lies within; he comes insensibly to think, without dismay, of dividing those parts in the living body which he has often dissected in the dead; and is able to perform an operation as he would a dissection, with the same fearless and rapid execution, where rapid execution is safe.

Most unhappily, an opinion has prevailed that the talent of operating is a gift of nature, not to be acquired: that men are born operators: and from this term natural operator, even men of sense and judgment do not revolt. The danger of this opinion requires that the subject should be seriously considered, for it is grievous to think what a relaxation of discipline, what a false and misplaced confidence may arise from such a prejudice, what daring unprincipled attempts to snatch at reputation, by those who imagine themselves natural operators, and who slightly run though superficial education, to rush at once into practice.

That a man, to become an operator, should be born with good natural talents, with a quick eye, and a steady hand, a mind endowed with firmness and courage, is indeed essential: but it is not less essential that he should study that profession to which he is to apply those natural powers; for of themselves, unqualified by education and knowledge, these natural powers are but the worse and more dangerous part of the character which the surgeon assumes, since, with the consciousness of natural address and courage, unsupported by skill, he may be induced to attempt operations unprepared, which are to be plainly learnt by dissection.

There is no such character as that of a natural operator, nor is there any other profession, learned or unlearned, which makes so bold a claim: a musician, a painter, a poet, become so by study and diligence: excellency, even in the works of genius, is attained only by labour, by the cultivation of the natural powers. If ever there was an inspired poet, it was Milton, who pours out his prayer "to that eternal spirit, that can enrich with all utterance and knowledge, and sends out his cherubim, with the hallowed fire of his altar, to touch and purify the lips of whom he pleases." Yet Milton boasts not of inspiration, he prepared himself with diligence, meditating during many years his immortal poem. He says, "I hope by labour and intense study, which I take to be my portion in this life, joined with a strong propensity of nature, I may leave something so written to after times as they should not willingly let it die."

Have we ever heard of a natural painter, a natural engraver, a natural musician? No, surely: labour and study must be joined with the strong propensity of nature. Enthusiasm for the beauties of nature, and admiration of the works of art, are the indications of genius; the passion for imitation creates only the desire; it is the handling of the tools of the engraver, the chisel, and the pencil, that gives the power of performing; and this power, improved by diligence and study, improves, in its turn, the genius of the artist: his flights of genius are bold and noble, whose fervour is not repressed by difficulty of execution, but who can give force to the highest conceptions of his mind.

Is it then natural to know the human body without dissecting it? Is it natural to operate on the living body without knowing its parts? No; let every young man, who is to study our profession, dissect with unwearied diligence, all the parts and organs of the body, and then only will he be able to know whether he was born an operator.

But I have observed those natural operators. One, persuaded that he is such, confident in his own natural powers, goes unprepared, to do the most important operations: he regards even the first opportunity of operating as an occasion of acquiring reputation, and making a public display of his talents: he trusts to chance, and hopes to find himself a natural operator; and dreadful must that misfortune be, which can persuade him that he is not; for while chance is allowed to have so great a share in his successes, it is but too natural for him to impute every misfortune to chance. Natural powers he may perhaps boast of, his eye may be as keen, his hand as steady, his mind altogether as bold and fearless as that of a well instructed man. But it is a boldness not qualified by knowledge; and if ever the slightest doubt comes over his mind, if his operation be perplexed or interrupted by any unexpected event, if once the occasion for real courage overtakes him, his hand trembles, his head swims, he would give the world that he might without shame and ruin lay down the knife! This is the cause, the sole cause, of that exultation, which bad operators, when they are at all successful, cannot conceal.

He who believes himself born with these natural talents, affects the manner of those who have attained to the reputation of being dexterous operators: his mind is not wrought up to any intense feeling of what his patient suffers, nor occupied with an intense desire to relieve him from the agonies of the operation: occupied solely with the vain and dangerous passion for applause, he thinks only how he may appear in the eyes of spectators. What are the spectators, and what is their applause, to the life of a fellow-creature? yet I fear that the custom of making every operation, every necessary and unavoidable cruelty of our art, a public spectacle for strangers to gaze on, and allowing the claims of those who, disregarding all the aids of study and experience, boast only of their natural talents, has been attended with the worst of consequences. Even in private life, operations have been hurried, which might have been deliberately and slowly performed: but the hospital surgeon, like one exhibiting on a public stage, loses no occasion of charming his assemblage of spectators into an opinion of his superior skill; hence his operation is all confusion and hurry, the incisions are performed with affected dexterity, the purposes of the operation are but ill accomplished, the arteries are imperfectly secured; and, in the end, he huddles up his work, to keep his time and to preserve the opinion, perhaps to excite the plaudits, of an unjudging mob. This passion for applause, so natural to us, so subservient to our interests, so flattering to our self-love, so apt to be excited by the presence of strangers, who are never to see us again, and are to judge of us by one single act of skill and courage,—this selfish and dangerous passion, which every ingenuous man must confess he feels lurking within his own breast, cannot be guarded against too much: if it is ever to be completely extinguished, it must be by a thorough study of the principles of the science, for a perfect education will carry a man's thoughts beyond this poor ambition.

A man perfectly educated, who is accustomed with dissection, and has fairly cultivated his natural powers, is occupied with higher thoughts. He looks inward for approbation, and cares not for the ignorant applause of those who estimate his talents, by the rapidity of his strokes! by the movements of a stop-watch! He imitates nothing of the turns and motions of others: every movement of his hand and knife is his own, and has a meaning; while the whole design of the operation is perfect in his mind. He has no vain nor selfish wish, no feelings but those of confident expectation and an intense desire to give relief; is absent to all external impressions, and unconscious of any thought which does not relate to his patient's safety. He affects no masterly turns of his knife or hand, no rapidity of execution, no airs of self-approbation to extort applause; but performs his operation in that calm, solemn, and impressive manner, which persuades his patient most eloquently of his deep regard: his whole deportment shows how conscious he is that he is inflicting cruelties, which, though well designed, may not prove useful; and though planned and conducted with prudence, may endanger life. If he operates with confidence, it is not of that rash and headlong nature, which arises from a vain assumption of natural abilities, of native courage, of address and dexterity inherited from his birth, but such as proceeds from a rational and modest study of that knowledge which is essential to success.

THE
OPERATION OF LITHOTOMY.

SECTION I.

CONTAINING BIOGRAPHICAL, CRITICAL, AND HISTORICAL SKETCHES OF THE MOST FAMOUS LITHOTOMISTS, AND OF THEIR OPERATIONS.

FIRST, OF THE APPARATUS MINOR, OR OPERATION OF CELSUS.

Such is the interest that men in all ages have taken in the success of this operation, that the various methods in which it has been performed have been faithfully recorded.

The history which I am about to lay before my reader is, I believe, full of amusement and instruction. Princes and parliaments have taken a direct concern in every thing that related to the improvement of lithotomy; and societies and convocations of learned men have endeavoured to improve the operation, while individual physicians labouring under the tortures of the stone, have undertaken deliberate experiments and dissections, and (looking forward to what they were themselves to suffer) have taught bold but unskilful men how to perform the operation with all the precautions which science and the study of anatomy could suggest: even a slight sketch of such a history must be gratifying; but it is more, it is useful, it is essential to the young surgeon, whose conceptions concerning this curious piece of dissection are not easily acquired! he must not only dissect the parts, but study the authors who have written on this operation. That surgeon surely would perform his operation with little confidence or courage (and it is one which requires much of both) who was ignorant of the history of the operation which he is to perform; of the men learned or unlearned by whom it was invented; of the surgeons rude or skilful in dissections by whom it has been improved.

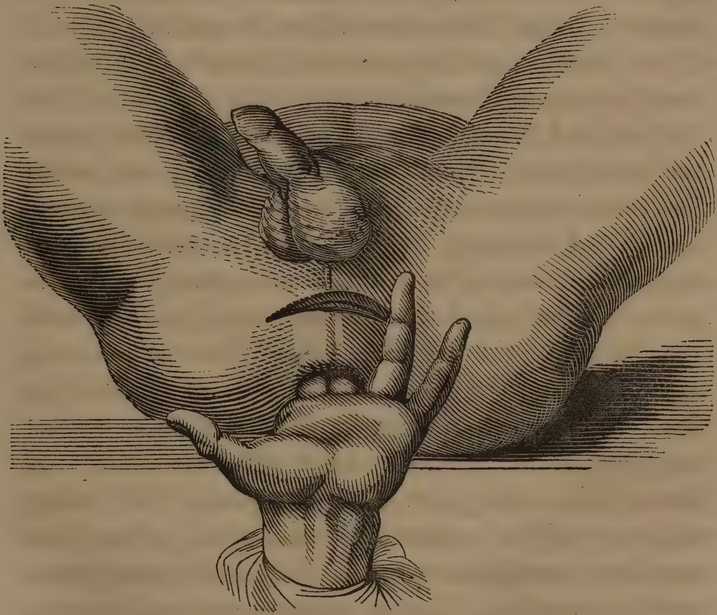
It is now supposed that the operation of lithotomy is reduced to such perfect simplicity, that it may be as well performed by the ignorant as by the skilful: woe to him that trusts to this simplicity, this mechanical correctness! For if a thing so paradoxical were to be believed, we might burn our books, forswear dissections, and study merely a few plain rules for guiding the gorget along the staff. Would this be teaching the operation of lithotomy? No, surely, men perform this simple operation with the gorget ill, chiefly because they know no other! He will surely acquit himself best in driving the gorget into the bladder, who knows how to cut safely with the more simple apparatus of a knife and a staff.

Before anatomy was studied or more curious operations invented, men were cut for the stone, and, as might naturally be supposed, by a method very plain and simple. The stone in the earlier times of surgery was discovered, not by introducing a staff, but by feeling it from the rectum with the fingers; and no sooner was it remarked that the stone, the cause of such excruciating tortures, could be discovered by the fingers and pressed from within against the perinæum; than the idea naturally presented itself of cutting the intermediate parts with a razor and extracting the stone with a hook. This operation, from the use made of the fingers in pressing down and holding the stone, was named cutting by the gripe, in contradistinction to the modern operation of cutting upon the staff: and when, in after ages, more complicated operations were invented and various instruments used, this was named the apparatus minor or lesser apparatus, from its being performed with no other instruments than a knife and a hook.

This was the operation naturally resorted to in early ages by a people not skilful in anatomy, nor fearful of future consequences, and anxious only about extracting the stone; it has been all along the favoured operation of quacks, whose want of education excluded them from all knowledge of better operations, and whose chief ambition has been safely or unsafely to extract the stone. But it has also been the favourite operation of men the most eminent in our profession, whose opinions claim respect, and who were not wanting in learning or skill, to compare this operation with others, and to do it every justice in the execution. Let me also confess that a predilection for this simple and ancient method of operating inclines me to deliver the history of it faithfully from the earliest times: let it not be regarded as any objection to this method that it is fit to be practised only in boys! for that is its chief excellence. In operating on a grown man, a voluntary sufferer, who resigns himself to the operation of lithotomy, although aware of all its dangers, in whom the parts being large, the incisions are made freely and the bladder presents itself fairly to the stroke of the gorget! we may with less reluctance and with less danger drive the gorget along the staff; but if, as I sincerely believe, this operation by the lesser apparatus can save us from the cruel necessity of driving the gorget with unrelenting hand among the viscera of a child, where the parts are small and the opening narrow; if this method of the apparatus minor be also a simple, easy, successful, unexceptionable operation; if it have fallen into disuse merely through lapse of time, and the death of those who were used to perform it, and from the disrepute into which itinerant operators are now fallen, with whom it was the favourite operation! what I have to say in its favour must be deserving of the attention of professional men. Those who have seen the gorget driven with unrelenting and horrible violence into the narrow pelvis of a child, will read the history of the apparatus minor with no ordinary degree of pleasure.

Besides these names of apparatus minor and cutting upon the gripe, this particular method was distinguished by that of the Lithotomia Celsiana, from the elegant description given of it by Celsus, who speaks of it in these terms: " Since I have, in describing the introduction of the catheter, mentioned the bladder of urine and the stone, the occasion seems to require that I should describe that operation, which, when all other methods fail, must be performed on those who are afflicted with the stone: an operation which, since it is full of danger, must never be rashly performed, nor at all times and seasons, nor in all ages, nor in all degrees of the malady! but only in the spring, in boys from nine to fourteen years of age, and where the disease is so desperate that it can neither be cured, nor even alleviated by medicine, but where the person must die in a little while. Therefore when it is resolved to try this only chance, let the body be prepared, for some days, by a due regimen, by moderate diet, by avoiding heavy meats, by drinking water alone; and during this term of preparation let the patient walk about, that the stone may descend towards the neck of the bladder, which will be known by introducing the fingers after the manner I shall presently mention in describing the operation: when thus assured that the stone has fallen down, the boy being made to fast for one day, the operation must be performed in a warm place according to the following rules.

"A strong man, accustomed with operations, being seated on a high chair, takes the boy in his arms, the boy's back inclining in a supine posture upon the assistant's breast, his hips resting upon the assistant's knees; his legs being then drawn up and his arms passed round his hams, the assistant takes hold of them and keeps the boy firm in this posture. But where the lad is grown up and strong, two men must sit on two chairs side by side, the chairs and the thighs of the assistants where they touch each other being tied fast together; when, the boy being seated on their two knees thus joined, each takes hold of the arm and leg next him, holding by the hand of the boy and pulling back his hams; and whether one or two assistants hold the boy, his shoulders must be steadily held down by leaning hard upon them with the breast. By this extension of the thighs the region of the pelvis is spread out without folds or wrinkles, while the bladder is so compressed as to make it easy to reach the stone; by the sides of those who immediately support the boy, there are placed two strong assistants, who steady them and keep them down to their seats.



"Then the physician, having pared his nails carefully, insinuates two fingers, the fore and mid fingers of the left hand, gently, one after another, into the anus; spreading at the same moment the fingers of the right hand over the lower part of the abdomen, to prevent the necessity of hooking his fingers too rudely round the stone, by which the bladder might be injured. And this must by no means be rashly done, as too frequent it is, but with all possible prudence, for a hurt of the bladder in that way may bring on convulsions and death: First of all let the stone be sought for at the neck of the bladder, where if it be discovered, it is more easily turned out through the wound; for unless the stone be thus distinctly known by its proper marks, the operation should not be attempted. But if the stone either be not at the neck of the bladder, or have receded from it, the fingers must be pushed deeper towards the bottom of the bladder, and the right hand also being carried behind the stone, must help to work it forwards; and when the stone is within the gripe it must be the more cautiously and carefully handled in proportion as it is small and smooth; for a small and smooth stone is apt to slip back, and to occasion much handling and tormenting of the bladder. For these reasons the fingers of the right hand are pressed in behind the stone, while with the fingers of the left hand it is wrought downwards to the neck of the bladder. If the stone be oblong, let it be presented, lying along with one end turned towards the wound; if flat, with one edge towards the wound; if square, resting upon two of its angles; if bigger towards one end, let the smaller end be presented to the wound. Whereas when the stone is round, there can, from the figure of the stone, be no difference in which posture it is presented; but from its roughness there may; if in a rough stone there be one smooth part, let that part come foremost.

" Matters being thus prepared, the incision is to be made through the skin down to the neck of the bladder, of a lunated form, not far from the anus, and with the horns of this lunated incision looking towards the hips. Then, in the deeper and narrower part of the wound, is to be made a second incision, also transverse, into the neck of the bladder itself, till the flowing out of the urine shows the incision to exceed in some degree the size of the stone. Those, who for fear of fistulas (which the Greeks call uriades) make their incision too small, fall another way into the same or a greater danger; for the stone, being thrust strongly forwards into the wound, must force an opening where it does not find one sufficient for its exit, a thing especially dangerous when the stone is rough or of an unfavourable form, for thence arise sometimes hæmorrhages or convulsions of the nerves, which although the patient may escape, yet the fistula must be much wider, when produced by laceration of the neck of the bladder, than by incision.

" The neck of the bladder being thus opened, the stone itself comes into view, which, if small, is to be got out with the fingers alone, the fingers of the left hand pushing it forward from within, while the fingers of the right hand help to pick it out: but if it be larger, a hook, made on purpose, must be slipped in behind it; the slender extremity of the hook should be flattened and bent into a semicircular form, smooth on its back part, where it presses against the parts, and rough within where it touches the stone; and it should be rather long, for a shorter hook has little power.

" When the hook is fixed behind the stone, it must be moved from side to side, to work the stone forwards; for the stone, if it be fairly catched by the hook, moves along with it: whereas, if you merely press upon the stone without moving it thus from side to side, it will slip, it will escape again into the bladder, and the point of the hook will strike against the edges of the wound, the danger of which we have already explained. Having secured a fair hold of the stone, you are to perform, at one moment, three several motions, viz. from one side to the other and directly forwards, but all quietly, taking care first to draw the stone a little downwards. Finally, the handle of the hook must be raised, that the lower end may pass deeper behind the stone, which may then be more easily protruded. The stone, if it be not easily catched from above, may be extracted by slipping in the hook at one side."

—" Hæc est simplicissima curatio."—This then is the pristine operation described by Celsus, with much simplicity and plainness; nor would I pursue his narrative one word farther than this natural close, were it not to say, that Celsus, in perfect consistency with the above doctrine of the dangers arising from much violence or a narrow wound, orders the stone to be divided when too large to pass without injuring the parts. He says, " When at any time the stone is too large to be extracted without laceration of the neck of the bladder, it is to be broken; an operation certainly invented by Ammonius, whence he was named Lithotomus, or the Cutter of Stones. The operation is to be performed after the following manner: A hook is to be so insinuated behind the stone as to resist and prevent its recoiling into the bladder, even when struck; then an iron instrument is used, of considerable thickness, but flattened towards the end, thin but blunt; which being placed against the stone and struck on the farther end, cleaves it; care being taken at the same time that neither the fragments of the stone fall back into the bladder, nor the bladder itself be injured by the instruments."

COMMENTARY ON CELSUS.

This, being the earliest record now in existence, deserves our particular notice: it cannot indeed be in all points correct, since it is doubtful whether Celsus was a physician, or ever took any direct share in the practice of our profession; assuredly he was not a surgeon, and least of all a lithotomist, for the operation of lithotomy was interdicted to all but those whose peculiar profession it was to perform it. Celsus knew the operation only as a part of the science of medicine; he describes it in such terms as a spectator would naturally use, and he makes indeed a sort of apology for describing an operation so peculiar and so foreign to the general plan of his writings. "But since I have, in describing the introduction of the catheter, mentioned the bladder of urine and the stone, it is natural to describe that operation which, when all other methods fail, must be had recourse to by those who are afflicted with the stone."

Many of his remarks on the several points of the operation, and all his directions concerning the after-treatment of the patient, bespeak him a most attentive and curious observer of whatever was done by the lithotomists. He allows the blood to flow freely during the operation, to lessen the risk of inflammation: he lays the patient on his back with the head low and the hips raised, covering the wound with cloths dipped in cool vinegar, and two hours after the operation, immerses him in a bath of hot water, which, as he lies supine, covers him all over from the knees to the navel; in this bath the patient was allowed to remain till he began to faint. The patient being then taken out of the bath was anointed with oil, and handfuls of plucked wool, dipt in warm oil, were applied to the pelvis, and hips, and groins, and to the wound itself. Warm poultices he condemns as more injurious by their weight than useful by their heat, "plus pondere nocent quam calore proficiunt." Nor does he allow the slightest bandage to be applied. But what proves more particularly that Celsus was familiar with all that is usually done by lithotomists is, that he marks correctly the signs of extravasated blood, and directs how it is to be removed; for "if," says Celsus, "there is on the following day a difficulty of breathing, a retention of urine, and an intumescence of the lower part of the abdomen, it is plain that blood is coagulated in the cavity of the bladder; then the fingers are to be introduced, the bladder is to be gently handled, and whatever clots are there, being thus broken down, will be spontaneously discharged. If this fail, an injection of vinegar and water is to be thrown into the cavity of the bladder, which is another way of dissolving clots of blood."

These things could not have been reduced thus to system, unless the operation had been long known and daily practised; nor could they have been thus correctly detailed by Celsus, but from the information of professed lithotomists. It would be extraordinary indeed if a writer like Celsus were really ambiguous in all the most interesting passages of this description; this has been confidently affirmed, but I should ascribe the doubts among commentators rather to their own subtilty, than to the difficulties of the text; it is plain that they miscarried for want of knowledge! they imagined a classical education sufficient for the reading of Celsus! The translators of Celsus have been physicians ignorant of surgery, and ignorant, of course, of the technical peculiarities of the language in which those disputed passages are written.

One expression, the "plaga transversa," has greatly perplexed translators, though the sense is very plain. The incision made by Celsus crossed the centre of the perinæum, and was in all respects transverse with regard to the bladder as well as to the external parts: "A lunated incision is to be made down to the neck of the bladder, with the horns looking towards the hips; and there, in the deepest and narrowest part of the wound, is to be made a second transverse incision into the neck of the bladder itself." The incision of Celsus then was lunated, and could not be at once lunated and longitudinal. Secondly, the horns of this lunated incision pointed to two corresponding parts, call them the two hips, or the two thighs, which you please: now had the incision not been, in every sense of the word, transverse, its horns could not have pointed to the two corresponding parts, but to the pubes and anus.

Thirdly, The deep incision is described in these words: "Altera transversa plaga," a second transverse wound, which expressly implies, that this second wound is to be a transverse wound; and these words are at the same time as definite and relative a description of the first as of the second wound. Fourthly, the same precise expressions are used by Celsus in describing the operation on women: "For women," says Celsus, "on account of the shortness and wideness of their urethra, pass the smaller stones; yet, when the stone is large, the same incisions are required as in men. In virgins the fingers are to be introduced into the rectum, as in boys, for the purpose of holding down the stone; but in married women the fingers are to be passed into the vagina: in virgins the incision is to be made on the left side of the labium, in married women it is to be made betwixt the meatus urinarius and the os pubis; in both, the incision is to be transverse, nor is there any reason to be alarmed, although, in women, there should be a profuse hæmorrhage."

The incision in women, as in men, was made on the perineum: "Tum virgini quidem, sub ima sinisteriore ora, mulieri vero inter urinæ iter et os pubis, incidendum est, sic ut utroque loco plaga transversa sit." Both in virgins and in married women the incision was transverse, and the variation in the precise place of the wound was obviously regulated by the state of the parts: in virgins it was below the vagina, because of the vagina being as yet undilated; but it was within the vagina in married women, betwixt the urethra and the pubes *.

There is one passage of Celsus which might have served as a lesson for all succeeding ages, and as an authority (for they have proceeded solely upon authority) for making those free incisions on which the fate of the patient so much depends. "Those who, for fear of fistulas, make their incisions too small, fall another way into the same or a greater danger; for the stone, being thrust strongly forwards into the wound, must force that degree of opening which it does not find; and this is especially dangerous when the stone is rough or of an unfavourable form; for thence arise, sometimes hæmorrhages, sometimes convulsions of the nerves, which even although the patient should escape, yet there is greater danger from laceration than from incision." The words of Celsus are indeed very memorable; and though in the dead, as in the living languages, the quaintness of the antithesis is not always to be received as a

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* "De Calculis Fœminarum. Hæ vero curationes in fœminis quoque similes sunt; de quibus parum, proprie tamen quædam dicenda sunt. Siquidem in his, ubi parvulus calculus est, scalpellus supervacuus est; quia is urinam in cervicem non compellit, quæ et brevior, quam in maribus, et laxior est. Ergo et per se sæpe excidit, et, si in primo, quod est angustius, inhæret, eodem tamen unco sine ulla noxa educitur. At in majoribus calculis necessaria eadem curatio est. Sed virgini subjici digiti tanquam masculo, mulieri per naturalia ejus debent. Tum, virgini quidem, sub ima sinisteriore ora: mulieri vero, inter urinæ iter et os pubis, incidendum est sic, ut utroque loco plaga transversa sit; neque terreri convenit, si plus ex muliebri corpore sanguinis profluit."

proof that the maxim is sound; although in modelling the sentence into this alliterative form, the sense is exaggerated, and truth and correctness sacrificed to sound; yet in science, as in morals, there are certain important axioms which should be thus enforced: for the most positive affirmation, or the most logical proof, could not give to any important maxim so strong a hold of the reason and memory as the correct opposition of two simple words. It is therefore much to be lamented that this particular maxim has not been remembered in the very words of Celsus: "Multo tamen patentiorem fistulam habiturus est rupta cervice quam incisa."

And I hope that my reminding the profession of this old and well proved maxim will prevent, in future, those long and murderous operations, where the surgeon labours for an hour in extracting the stone, to the inevitable destruction of the patient.

Science, like history, has its fabulous and dark ages, in which things achieved by the most simple means seem wonderful, and arts at one period generally known, sometimes fall into oblivion! so it was in regard to this operation, which, after being performed by Meges and Ammonius (near the times of Hippocrates), and described as a spectator by Celsus, came at last to be entirely neglected and forgotten by men of science, and to be practised only by quacks. The distance indeed is never great betwixt that period in which men, under the title of Lithotomists, Herniary surgeons, or other titles, claim certain operations as peculiarly their own, and quackery, or those arts and deceptions by which such claims are maintained. During many centuries, quacks were, in regard to hernia, fistula, and various diseases, the chief operators, and they were the only lithotomists. Though such operators were contemned by the learned, they were the idols of the vulgar; many among them operated to admiration, and one especially had the honour of attracting, in a peculiar manner, the malignity of the profession.

This was Le Raoues, a lithotomist, who operated about a hundred years ago in the principal cities in the south of France. He practised a method not expressly known to Van Horne, who only mentions the wonders this man was reported to perform, as an incitement to others to discover and practise his way of cutting for the stone.

"I must not in this place neglect," says Van Horne, "to mention what was reported to me six months ago, by a nobleman, who had not only witnessed in others, but experienced in his own person, the happy talents of one Raoues, a lithotomist, of Nismes, in France, who cuts men of all ages with singular address, without the usual ligatures, without other apparatus than a knife and hook, placing the patient merely on the knees of his assistant. For he is very skilful in catching the stone with his fingers, and pressing it so against the perinæum, that, upon making a slight incision, the stone starts out of its own accord: nor is this all, for after the incision there is no hæmorrhagy, nor does there pass even one drop of urine by the wound: which is easily explained; for the incisions of the skin, and of the internal wound, do not correspond; and, incredible as it may appear, the parts are healed in five or six days; so that on the ninth day this nobleman walked round the city with his operator. Satisfied of this fact, not by report, but by being in a manner a spectator of what was performed on this nobleman, I hold it right to relate the whole, that it may incite others to learn and practise this method."

The best and most learned men of that age have spoken with enthusiasm of the operations of Le Raoues. Roonhuysen, in his cases, translated into English in the year 1676, speaks of this operator in the following terms: "At this very time we understand, both by letters and from patients, something very considerable touching a new contrivance of cutting the stone, practised in France, at Bourdeaux, by a lithotomist called Raoues de Chastres, now dwelling at Nismes, used both upon old and young, and that after a quite other manner than hath been practised hitherto. For after that the patient hath been sounded and felt by the artist, after his own way, without any body's being present, he then, together with the patient, walks for half an hour in his chamber, and then puts him in his servant's lap, who holds the patient's legs without tying him, and the master useth no other instrument but a little crooked knife, and no bands; nor doth he use any force in pressing the belly, in lifting it up or the like, thereby to get the stone between his fingers. It is also done with less trouble and danger, without as much as observing the season of the year, the temperament of the patient, or his age. He only thrusts two fingers into his fundament, so as to get the stone; which having compassed with little pain, he conveys it to the os ischium as far as he can, and then a little higher, making an incision with his little crooked knife, of the usual bigness, but somewhat higher and obliquely, beginning from the side of the said os ischium, and so continuing to the perinæum; which incision or opening is more (in that place) according to the grain of the fibres, as will be found if viewed attentively. Now a small incision made according to the grain of the fibres will yield much more, and can, by laceration, be somewhat widened if it have been made too little (for the wound that is to be made in cutting the stone is better a little too small than too great); and by this means, with his fingers, he easily draws out the stone without the use of any other instrument; and after having cleansed the wound, he conveys and thrusts back the bladder to its place, whence it had prevented also the droppings of the urine, by dressing the patient with an ordinary band, who in seven or eight days is positively cured. I have also read a printed letter, intitled La Nouvelle Manière de Tailler la Pierre; *i. e.* The new manner of cutting the stone; wherein it is affirmed, that then this master had already cut, after this way, above fifty persons, of twenty, thirty, forty, fifty, and sixty years of age, with so good success, that not one of them all had died, yea, that very few or none of them had had so much as a fever. Thus you see, that art is more and more improved by continual discoveries, for which we ought to praise Almighty God, vouchsafing such and the like new remedies to the benefit of mankind."

But the physicians of Paris could by no means regard the appearance of La Raoues as the sign and working of God's providence in behalf of mankind. They pursued him with their utmost malice, and prevailed, at last, on the learned Drelincurtius to come forth the fool of the pantomime, the —— of their plot. They set him the task of representing this innocent man in the most ludicrous and most detestable point of view: they called Le Raoues a new saint, and required Drelincourt to write the legend of his miraculous cures in terms of derision, and to alarm all France with relations from which modesty and decency must revolt.

"The head and front of his offending" was only this: that having operated with singular success in the towns and provinces of France, he ventured at last to appear in Paris, and had the audacity there to obtrude himself (in the house of Bourdelot the king's physician) into a society of learned men; where, in the presence of His Highness the Prince of Condé, he vaunted of a discovery, which he said he had discovered four years before, of cutting for the stone by a new operation, more expeditious, safe, and easy, than that of the great apparatus then in use.

This operation Drelincourt proceeds to describe in the following terms: "He operates like all other quacks, by cutting upon the gripe; he feels for the stone with his fingers in the rectum, makes the patient, before operating, walk a turn or two through the room to bring the stone to the neck of the bladder; he places him in the lap of a strong assistant, who, joining his hands over the patient's belly, presses, with the help of compresses, upon the epigastric region; when he is about to cut, he introduces his fingers very high in the rectum, and seizes and fixes the stone with equal ease in boys and in grown men. "I was astonished," says Drelincourt, "when I saw what must have seemed incredible had it been only reported to me: he introduced not two fingers into the rectum, but three, and passed them till his hand was stopped by the thick flesh of the muscles of the thumb, in a manner which I never could have conceived, but I have seen it, and have seen it with horror. (C'est un fait que je ne pouvoit m'imaginer; mais j'en ay été témoine oculaire, et j'en ay eu de l'horreur.) Holding his victim thus impaled, he curved the points of his fingers very strongly, pressing the coats of the rectum violently towards the bladder; and through the coats of the bladder, and the three coats of the rectum, does this operator discover not only a stone, but any number of stones, their size, smoothness, roughness, softness, hardness, weight, and colour even. Then catching the stone betwixt his fingers, placing it in a favourable direction, and pressing it down towards the tuber-ischii, he at once presses down the stone with the fingers, and extends the skin over the perineum (by drawing it towards the right side) with the thumb of his left hand; and taking in his right the knife or razor, which till then he holds in his mouth, he cuts upon the stone with a sort of lunated incision, the horns of which look towards the left hip: he then cuts deeper, dividing through the erector muscle of the left side, cutting an inch above the anus, and nearly an inch to the left of the rapha perinæi. The incision is continued till the knife grates upon the stone; then pressing the bladder at once with both hands, with the right above the pubis, and with the left from within the rectum, the stone leaps out into his breast or shirt collar, or if it do not, is picked out with the fore-finger. Thus does he extract the stone from the biggest and fattest person with ease."

"Now forsaking," says Drelincourt, "his hold of the bladder within, and of the skin without, he allows the parts to be retracted, by their natural elasticity, different ways; the bladder returning to its natural place, recedes towards the right; the skin of the perinæum is retracted towards the thigh, i. e. towards the left; and the wound is so closed that the urine immediately passes the natural way."

"The patient, after getting up, making a few steps and strides about the room," says Drelincourt, "to clear the bladder, or shaking himself, or jumping over his garter, is laid in bed; and this jack-pudding of a charlatan plasters up his bottom with a paste of flour and eggs; and keeping a mountain of flour over the wound, thus bandages his posteriors."

Although Le Raoues had cut hundreds for the stone in Rouen, Bourdeaux, Nismes, and other cities, it was boldly affirmed that he had cut those only who had not the stone: it was thus that his rivals thought fit to explain the miracles he seemed to perform.

This tale is told by Collot, his most invidious rival, in very plain terms: "Le Raoues," says Collot, "having operated on many in Bourdeaux, who had not the stone, received the thousand pistoles which these operations produced him, and made his escape: he soon after arrived in Paris, where, being more narrowly watched, he was detected in his arts and practices: he was observed to make an incision in the hip, too superficial even to reach the bladder or internal parts, much less to cut through them; and the stone produced by this operator was one which he held in his sleeve, dropt into the palm of his hand at a fit period of the operation, and presented to the spectators, soiled with the blood of the wound: nay the enemies of Raoues affirmed, that some of those who died by accident after these superficial incisions, were found (upon opening their bodies) to have in the bladder, many stones, without the slightest scar or mark of the incision having ever reached that part."—"One day," says Collot, "while Le Raoues was cutting a boy for the stone, the servant was detected in the act of slipping a stone into the master's hand; who, for fear of a prosecution, withdrew himself from Paris, and was never heard of more."—"These," says Collot, "were the tricks by which he had raised a momentary reputation in the provincial towns; and these were the sort of operations he had performed with such applause at Bourdeaux."—"Il est vrai qu'il en tailla plusieurs à Bourdeaux; cependant on ne fut que trop persuadé dans la suite qu'il n'y avoit pas un seul de ses malades auquel il n'eut supposé la Pierre." Collot, sur la Pierre.

This is a tale founded in malice, and hardly deserving of refutation: Le Raoues was in possession of a plain, simple, successful operation, which he well knew how to perform, and had as little need as Collot himself to resort to artifice. But it was the practice of the surgeons and lithotomists of Paris, the moment they found their province invaded, to fabricate the most scandalous falsehoods. Collot was the king's lithotomist, and his family continued so for many generations; he could not but feel jealous and indignant at this low and ignorant man assuming the title of lithotomist. Le Raoues must, from every circumstance in his situation, have had many enemies; and it is surely more natural to believe that cunning and interested men contrived these tales, than that even the most unprincipled wretch could dare actually to commit such cruelties: so atrocious is the crime alleged against Le Raoues, that he must be acquitted. If he did indeed persuade the people to submit by scores to the operation, without having suffered the torments of the disease, and persuaded the spectators that they saw him extract the stone, he must, with all the address of an empyric, have had "a tongue that could wheedle the devil!"

But he was belied: his operation, even as described by his enemy Drelincurtius, is superior to any practised by the family of Collot. The Collots traduced him, and accused him of making incisions when he had no intention of cutting for the stone! but full sorely did this same family of the Collots suffer in their turn: they were accused by others of the same crime: "even-handed Justice was in this most just, commending the ingredients of their poisoned chalice to their own lips." Collot, the father, was himself afflicted with the stone, and the operation was performed by his son! This was a painful and terrible act of duty and obedience! What was the young man's reward? what said the rivals of this family?—That it was a mock operation, well concerted betwixt the father and the son, as if Collot could not bring his son into the world by any device, but by being at the same time delivered of a stone*! Yet so much did this villanous report prevail, that the editor of Collot defends him from the accusation. "Des esprits soupçonneux ont cru qu'il n'avoit voulu donner qu'un example de confiance; mais des témoines oculaires m'ont confirmé qu'il avoit la Pierre." Such were the arts in use in this abandoned city; which a man, so meritorious as Le Raoues, and so unsupported, could not escape, could not withstand.

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* The family of the Collots operated with the apparatus-major, which is next to be explained.

After many other contemptible inventions for bringing this man into disrepute, Drelincourt had the meanness to alarm the people of France about the pollution of their women, in terms incredibly low and abominable. "Digitos suos salaces et improbos in sinum pudoris lascive et nequiter adigit, sique in nubæ cristas terit, ipsa virginalia claustra rumpit. Pudibundone quippe et anilissimum pudicitiæ ocellum vix hiscentem illiberaliter et proterve legit atque decerpit. Imò cum sinat licet, en rubentem ejus gemmantemque calycem amicissime gemmarum connexu conjunctissimum necdum hiantem præmature explicat et diffundit."

This is horrible, and altogether abominable! it is addressed plainly to fanatics, priests, and partisans; and, through an affected modesty, it is (though in a French book) written in Latin, that it might be construed to every curious dame, by her confessor and domestic priest, with such comments as the text might require. Thus did the learned Drelincurtius set himself to the degrading task assigned him, with that fervour of malice "which outruns the pauser reason," and bartered away his academic honours for a cap and bells.

COMMENT ON THE OPERATION OF LE RAOUES.

Let us candidly, and for the sake of science, reflect on the nature of this operation, and condescend to receive one lesson more from a class of men who have already given us many that are very memorable. Every thing in this operation, that is thus condemned by Drelincurtius, is peculiarly commendable; his criticisms are most erudite, but most unskilful, so that we may venture to pronounce this man, "with all his learning, to have been the most ignorant man in Europe." His raillery could not but be misplaced, since he criticised what he could not understand. He was not aware that this was an operation to be improved, not by learning, but by practice! the operation had indeed been improved, by those itinerant lithotomists, to that degree of excellency, that we may subscribe with confidence to the rules and practices of Le Raoues.

Le Raoues is accused of making his patient walk round the room to bring down the stone to the neck of the bladder. What says Celsus to this practice? "Ambulandi vero inter hæc exercitatione utatur quo magis calculus ad vesicæ cervicem descendat." This is the same rule delivered in language which Drelincurtius would not have ventured to dispute.

The practice of bringing down the stone to the neck of the bladder had been in use, wherever the operation by the apparatus minor had been performed. Parée particularly recommends the practice. The grave and learned Roman makes the patient perambulate the chamber: the merry Frenchman makes him dance till it falls down: "Ayant dont supposé que nous avons un jeune enfant à inciser, il faut premièrement que le chirurgien le fasse sauter cinque ou six fois à fin de faire descendre la pierre au fond de la vessie." But Van Horne is still more amusing, and requires, I think, too much agility and spirit on the part of his patient: he makes him, after dancing a while, leap from the highest stools in the house: "Jubemus ægrum aliquoties subsilire, aut bis terve de scamno aliquo desilire ut calculus deorsum prolabatur ad collum vesicæ."

La Raoues was next accused of "pretending to feel through the coats of the bladder, and through the three coats of the rectum, the size, smoothness, roughness, softness, hardness, weight, and colour, of the stone." What says the text of the classical Celsus to this point? Celsus certainly instructs the operator how to recognise a rough, a smooth, an oblong, or flattened stone, and how to present it so to the perinæum, as to pass through the wound in the most favourable way. Celsus indeed presumes every thing to be distinguishable through those same coats of the rectum, except the colour of the stone; and the colour of the stone, though it was of no importance in the opinion of La Raoues, was of singular importance in the opinion of Drelincurtius, since it enabled him to represent Le Raoues in terms of ridicule.

Le Raoues was accused too of thrusting more than two fingers, of driving almost the whole hand, into the rectum, in a manner which struck Drelincourt with horror: but what avail the horrors of a man ignorant in surgery, and unaccustomed with operations? The horrors of Drelincurtius are of no more importance than the tremor of a woman or a child at the sight of blood. Every person who stands as a mere spectator to witness the unavoidable pangs of an operation, must have acute feelings; but if he do not understand what is useful and what is hurtful in that operation, his feelings must be but prejudices of little account. Drelincurtius never thus handled a stone to estimate its form or size, while Le Raoues had searched thousands, without the help of the catheter. The distinctness with which the stone is felt with the finger must have appeared incredible to a physician; even to surgeons I am sorry to think how little this sensation is familiar. Surgeons introduce the staff because they are to cut upon it; but they are indifferent about feeling with the fingers the actual size of the stone. They make their incision without being able to ascertain whether it be proportioned to the size of the stone. Now this is strange! A surgeon would not choose to open an abscess of the neck, or of the perinæum, without wishing to know whether such abscess opened into the throat, or urethra, or rectum: yet the surgeon who examines a slight abscess carefully, and opens it with circumspection, plunges his gorget into the bladder, without condescending previously to put his finger into the rectum; he trusts to the clicking of his staff, and is indifferent about the size, if he be only sure of the existence of a stone. That Le Raoues was forced to grope hard for the stone was the inevitable consequence of his venturing to do what regular surgeons have seldom done; for they, in operating with the apparatus minor, have cut boys only; while Le Raoues cut men of thirty, fifty, and seventy years of age.

Second, Had Drelincourt attended to those lessons which Le Raoues offered freely to every surgeon, he might have been taught by him, that to feel the stone distinctly and reach it fairly in the adult, and to hold it firm even in a younger subject, both skill and boldness, and the introduction of more than two fingers are required.

It stands then upon record, that Le Raoues was particularly careful to ascertain the size of the stone, for which purpose he carried the patient into a private room, and there, alone, or with his servant, examined by the rectum; that when he brought him out for public operation, he showed particular address and boldness in catching the stone under his fingers, pressing it firmly against the perinæum, and making it even leap out into the collar of his shirt as soon as the incision was performed; that before he made his incision, he drew the skin powerfully to the right side, and holding it so with his thumb, while he performed the incision, allowed it then to be retracted so as to cover the deeper wound; and that he moreover endeavoured to ensure a perfect adhesion, by closing the wound nicely with flour mixed up with the white of eggs *. When I observe all these wise and rational precautions, I am fully persuaded that this operation had been gradually attaining to great perfection in the hands of practical men, who were so far rude and ignorant as to know no other; and can easily believe what the admirers of this Le Raoues

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* All this attempt to close the wound is particularly dangerous, as will appear in the sequel.

affirmed, that he was sometimes able to carry his patients abroad in not many days *.

Drelincourt had the misfortune to criticise steps in the operation which he could not comprehend; and the confidence with which he exposes what he thinks errors on the part of Le Raoues may serve as a warning to men whose propensities lie this way, who think themselves men of wit and merriment, and regard ridicule as the test of truth.

ANATOMICAL ANALYSIS OF THE APPARATUS MINOR.

But this operation gradually improving in the hands of practical men, insensibly attained to a degree of perfection not yet remarked, and which consisted not merely in the dexterity with which the stone was grasped and held down, nor in the provisions for a speedy reunion of the wound, but in the direction and form of the wound itself. The incision for lithotomy was, from the time of Hippocrates, Ammonius, and Meges, down to the days of Celsus, transverse

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* This is a fact reported indifferently by the friends and by the enemies of Le Raoues. Mingelouzeau reports that by his management of the parts by drawing aside the skin with the thumb of the left hand, while he cut with the right; by allowing it to be retracted after the extraction of the stone, his patient immediately passed the urine the natural way; nor can we wonder at this, since the same happens in our deep and direct incision. He also informs us that Le Raoues cut the neck of the bladder at the same time with the integuments. He says that while Le Raoues cut boys only, he succeeded, but when he ventured to perform this operation on adults, he was less fortunate. "Et il se trouvoit que la playe du col de la vessie ne repondoit plus à la playe des intéguments, mais en étoit couvert; et le malade ne rendoit point son urine par la playe, qui se renfermoit très facilement." In the city of Bordeaux alone (says Mingelouzeau) he cut eighty-two persons of various ages for the stone.

and lunated; it crossed the perinæum near the anus, and it was still of a lunated form in the time of Le Raoues, who made, according to the description of Drelincurtius, " a lunated incision nearly an inch to the left of the rapha perinæi, and with horns looking towards the left hip:" this man, in short, cut in a sort of semicircle round the tuber ischii. At some period of which we have no distinct record, but probably near the time of Le Raoues, lithotomists changed this lunated for a longitudinal incision. Frere Jaques had two operations, the one, viz. that by the apparatus minor, in which he cut upon the stone; the other peculiar to himself, in which he cut upon the staff. Perhaps he learned his operation by the apparatus minor, from Le Raoues: in performing the incision he would naturally carry his knife longitudinally and in the same direction that he did in cutting upon the staff, which was his own peculiar operation.

" Having assisted," says Mery, " at all the operations of Frere Jaques, in the Hotel Dieu, I have had occasion to observe his way of operating with the apparatus minor on little boys: passing the fore and midfingers of the left hand into the rectum, and laying the right upon the pubis, he grapples the bladder, and forces down the stone till it presents, in boys, in the perinæum, and in women, betwixt the vagina and pubis; and holding the stone firm with his left hand, he cuts with his right, making his incision from the tuberosity of the ischium towards the stone, so that betwixt his two operations, that by the lesser, and that by the greater apparatus, there is not the slightest difference with respect to the incision." Thus it came to pass, at what period we do not expressly know, that the incision by the lesser apparatus was approximated to that by the greater apparatus; the incision performed by the itinerant operators of the sixteenth century, with that performed in modern times by Raw, Chesselden, and the surgeons of the present day; for since the incision was in the same place in the same direction, dividing the same parts, it made no essential distinction whether it was performed, as among these itinerant operators, by cutting upon the stone, or as by modern lithotomists, by cutting upon the staff.

To understand how essential an innovation this was, we must apply to the present as to every other innovation, the test of anatomy.

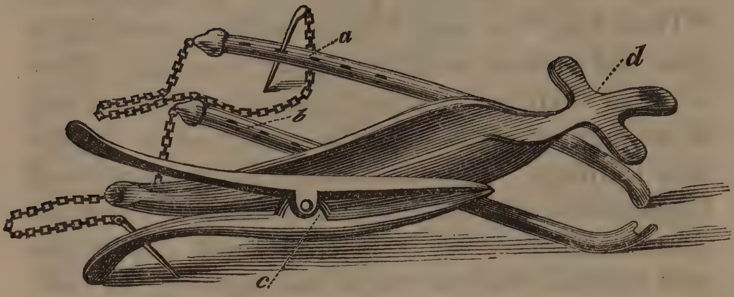
First, It will be obvious that the operation of the ancients is full of danger, for the parts cut must vary according to the degree in which they are protruded by the fingers; it is, no doubt, possible to perform the operation safely, for the parts may be protruded by the fingers in the anus, in such a degree that the lunated incision shall divide the neck of the bladder, and cut through the prostate gland, without injuring the vesiculæ or the urethra. Secondly, It is obvious that if the parts be in any particular subject larger, or (in consequence of the peculiar manner of the operator) more protruded, the incision will not be in the substance of the gland, nor strictly in the neck of the bladder, but behind the gland and across the two vesiculæ where they enter under the gland. Thirdly, it is manifest, that if the parts were less strongly pressed upon, the neck of the bladder and prostate gland would not be at all protruded, the incision would pass through the anterior part of the gland, and then the membranous or naked part of the urethra where it turns round under the pubis being interposed, would be cut off from the bladder, and if the patient survived the operation, he would labour under an incurable fistula. Such are the manifest dangers of this operation described by Celsus. Fourthly, It was plainly the chief advantage of the lateral incision (*i. e.* of the incision on one side of the perinæum), as practised in the time of Le Raoues and Frere Jaques, that it obviated this danger; in this lateral incision the urethra escaped, and thence Le Raoues, Heister, and others, who favoured this operation, practised it with a degree of success and safety, though, no doubt, among their patients also many died, and some had fistulas. But it must occur to any one who reflects on the posture in which the parts are held on the points of the fingers, that the slightest degree of obliquity in the wound, the slightest deviation of the incision from its due place, the slightest prolongation of the upper horn of that lunated incision (whether it has its horns turned towards the right or towards the left hip) would sever the urethra from the bladder.

Nor is this at all an imaginary danger: "On the 20th of May," says Mery, "I performed, in presence of Frere Jaques himself, accompanied by the surgeons and physicians of the hospital, the dissection of six boys cut by him for the stone; and in all the six we found the bladder separated from the urethra where it enters the penis, and the blood vessels of the penis torn across or divided by the knife. And, on the 2d of June, I dissected the body of a boy thirteen years of age, cut by Frere Jaques, by the gripe, in whom we found the bladder separated from the penis and from the pubis, the arteries and veins cut across, and the hæmorrhoidal veins also divided." These are fatal proofs of the ill effects of such irregular incisions, and serious examples of an excellent operation being ill performed. But all these dangers are obviated at once, by introducing the staff into the bladder, for that prevents a possibility of our cutting off the urethra, and not to cut into the neck of the bladder when cutting thus upon the stone itself is impossible. In this way my brother, Mr. Charles Bell, has performed the operation rapidly and successfully.

In operating by this lesser apparatus, you cut upon the stone, and cut of course, with perfect security, an incision exactly proportioned to its size. There is no difficult nor dangerous dissection; no gorget, nor other dangerous instrument, thrust into the bladder, with the risk of its passing in betwixt that and the rectum; you are performing expressly the lateral incision of Raw and Chesselden, in the most simple and favourable way; and, indeed, Raw himself, though he declined telling how he operated, always had the honesty to refer the inquirer to Celsus—"Legite Celsum" was always his reply. But what makes the deepest impression on my mind in favour of the apparatus minor is, that we are, by this operation, saved from the horror of plunging a gorget, blindfold, among the viscera of a child, a cruelty of which I never shall allow myself to be guilty again.

Could then an operation so simple, so successful, and which had been practised for so many centuries, be forsaken? Yes, surely: covetousness, vanity, and pride, incited physicians learned indeed, but little skilled in surgery, to invent more ingenious and complicated operations, forsaking the prisca simplicitas instrumentorum so warmly praised by Heister; for Heister himself practised the operation of the lesser apparatus, and explains to us the unworthy motives which induced physicians to abandon it. "Their fees," he says, "were melting away! their gains and honours were intercepted by quacks! They invented therefore new and curious operations, not to cut men more easily for the stone, but to display their learning. They first proved by an aphorism of Hippocrates, that wounds in membranous parts are mortal. Thence they deduced this rule, that, whatever external incisions might be required, the neck of the bladder itself should never be divided with the knife, but should only be dilated with instruments of various forms. The memorable maxim in Celsus they willingly forgot, "That there is greater danger in dilating the neck of the bladder, than in opening it by incision." They chose rather to dilate or lacerate the parts than to cut them. The simplicity of this method, by the lesser apparatus, and the facility with which it is performed, were indeed their chief objections to it. "Those," says Heister, "who choose to speak contemptuously of this method, represent it as an operation fit only for quacks and mountebanks, as an operation too low and contemptible ever to be practised by regular surgeons and physicians: modern surgeons," says he, "have invented more cunning and curious methods, such as the vulgar do not know; such as must captivate all ranks of men, the rich and great, as well as the vulgar, by the profusion and elegance of the apparatus."

Such were the contemptible motives which induced men in the earlier times of surgery to invent that complicated operation which I am next to explain.



SECTION III.

OF LITHOTOMY BY THE APPARATUS MAJOR.

THE OPERATION OF JOANNES DE ROMANIS, OR OF SANCTUS MARIANUS BAROLITANUS.

The operation dignified with the sonorous titles of Apparatus Major, and Marian Operation, was invented through motives of avarice, conceit, and folly, and by those who despised the operation of Celsus, because it was too plain, too simple, too easily performed, insomuch as to have become the favourite operation of ignorant men *.

a Male conductor. *b* Female conductor.
c Simple dilator. *d* Blunt gorget.

* I must protest against this often repeated argument. I believe the reason of this change was the same that has caused the hundred inventions since, viz. the real dangers and difficulties of the operation.—C. B.

They surely were ill qualified for inventing new methods, who declined the old because it was simple! that which they invented, assuredly was not so! it was with incredible difficulty they extracted the stone through the narrow incision which was made in operating by the apparatus major; and, amidst the violence of dilating the parts, the cries of the patient were such as it was not possible to hear without commiseration. Their dilating instruments, their apparatus major, which was calculated to impress the great with admiration and reverence, struck the patients with fear, and the spectators with dismay. If Heister is to be trusted, and he was himself a plain blunt man, we must believe this new invention to have been the most criminal ever engendered by the desire of gain! If we are to trust to those who saw it performed in all its perfection, it must have been the most cruel and horrible! what but cruelty and folly could result from the vain desire of receding, as far as possible, from an operation which was avowedly very simple, and easily performed?

The reasons which the inventors of this apparatus major were pleased to assign were but poor apologies for their conduct. They found out a text in Hippocrates, which declares, that "wounds of membranous parts are mortal;" and thence they inferred that, in performing the operation of lithotomy, the bladder itself should in no degree be wounded with the knife! They proceeded merely upon authority, and thought all was well if they could thus produce a text favourable to their design! The comments upon this text have been indeed perplexed and various, because, like musical accompaniments, they are modulated, ad libitum, according to the taste and genius of the performer.

They had the cunning to pervert a general aphorism, a prognostic concerning wounds of the viscera, to the particular purpose of regulating an operation which Hippocrates professed not to understand, and from which he seems to have had an extreme aversion. They affirmed that the ancient doctrine forbade wounding the bladder, without recollecting that Hippocrates interdicted this operation to his disciples only, because it was practised by particular men *; and that those professed lithotomists, Ammonius, Meges, and others, performed their operation from the times of Hippocrates down to those of Celsus entirely by incision. They forgot that it was the custom of lithotomists not even to use the forceps, but to cut so fairly, that, after the incision was performed, they bolted out the stone with their fingers, or picked it out with a hook. They quoted the ancients in favour of dilatation, and forgot the second or deep incision, the "altera transversa plaga," of Celsus, "quâ cervix aperiatur."

Those who invented the apparatus major deceived themselves, by reasoning on this supposed rule of Hippocrates; it was under pretence of avoiding membranous parts that they refused to open their way by incision, into the neck of the bladder: it was from the hopes of dilating the neck of the bladder as easily in man, where it is surrounded by the firm prostate, as in woman, where it is not so, that they

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* This was the part of the oath that related to lithotomy: "Neque vero câlculo laborantes secabo, sed magistris ejus rei peritis id muneris permittam."—HIPPOCRATES.

made their wound only upon the perinæum, opening nothing but the urethra, with the knife, and leaving the neck of the bladder to be torn by dilators. So much did they affect to fear the wounding of membranous parts, that they would not even approach the rapha perinæi, with their incision, but drew the skin to one side to avoid it. "Dextrâ vero manu," says Marianus, "dextrâ vero manu compactis æquatisque digitis, pelliculam ad sinistræ natis latus contrahat, ut commissura ad latus declinet, ne super ea incidatur quoniam esset malum. Est enim commissura secundum experientiæ veritatem locus mortalis, si super ea incideretur." Those who are most acquainted with the anatomy and texture of these parts will best conceive the horrors of an operation in which nothing could be accomplished till the prostate gland was burst up with dilating instruments of various forms, for, in operating with the apparatus major, they tore those delicate parts (perinæum and all) which they were afraid to cut, and talked confidently of dilating and gradually stretching the parts, while they were conscious of lacerating them.

This operation was invented by Joannes de Romanis, a surgeon, of Cremona, in Italy, who might perhaps have been able to tell a plain tale how his operation was to be performed, but who did by no means presume to write a book upon the stone. It will be recollected that the surgical observations of Paræus were leavened and kneaded up into chapters and sections, by certain learned doctors of the university of Paris; and the operation of Joannes de Romanis was in like manner delivered over to the talents of the learned and most eloquent Marianus

Sanctus Barolitanus, who describes it in magnificent terms. He seems at first ready to sink under the ignominy of his situation, when obliged to acknowledge that this august operation is to be performed even with a razor!—a barber's razor! but this humble instrument he ingeniously describes in a strain of most poetical metaphor. "Novacula Barbitonsorum peculiare est instrumentum quâ cum volunt barbam depexam abradere uno ipsius tractu mille ruunt capilli."—"The barber's razor, friendly reader, is a most important weapon, wherewith, when the business is to shave, cut close, and utterly subdue a stubborn and rebellious beard, the barber mows down the hairs, thousands falling before him at each remorseless stroke!" Never was the pride and pomp of surgery so nobly supported as by this big-mouthed Marianus Sanctus Barolitanus; not an instrument is there under the apron-string of the lithotomist, which he does not celebrate in equal strains; and as dilatation was the chief purpose of the operation, and dilators the peculiar and important instruments, the number of which characterized the operation, the description of dilators proportionally excels that of the razor. "Look but to the aperiens," (and that you may look at this gaping aperiens, it is drawn on his margin)—"Look but to the aperiens! how it gapes with desire, when the conductors have made way for its approaching, and, seizing the stone, it rages like the ferocious soldier ready to enter the breach in the walls of a besieged city."—"Si quis modo inspiceret qua hilaritate aperiens gestiat, cum ductores locum, quem illud viam ad lapidem extrahendam faciet præparâssent, ipsum denique crederet non minorem voluptatem animo fovere quam qui ad diruendam urbem, quæ diu obsidione milites fatigaverit, accinguntur." Next come the voracious and vociferous forceps, roaring, and gaping for the stone. "For this," says Marianus, "is the drawing of the forceps themselves, which often, when their morsel is too large for them to devour, cry out for the aid of their two supporters, or latera, which are then laid side by side with the forceps. Hæc est igitur forma ipsius forcipis qui sibi duo latera aliquando jungi vehementer vociferant; cum bolum quem ipse comprehenderat, præ magnitudine sine duorum laterum auxilio, foras extrahere minime valuerit." Such were the magnificent descriptions transmitted to us by Marianus, of that barber's razor which, put in motion by his hand, mows down millions of hairs, "uno ipsius tractu;" and of the gaping dilators and roaring forceps, vociferating for help, and raging for the stone.

These poetical eulogiums of the apparatus major do not belie the intentions ascribed by Heister to innovators. To separate the sense from the extravagance of these descriptions, and tell plainly what sort of operation they performed, is no easy task. It would appear that the operator, kneeling on one knee, made an incision, with his razor, along the perinæum to one side of the rapha; and feeling with his little finger for the curve of the staff, he opened the membranous part of the urethra, and fixing the point of the knife in the groove of his staff, gave it to an assistant to hold while he passed a probe along the knife into the groove of the staff, and thus into the cavity of the bladder. When the probe was thus passed into the bladder the urine flowed out, and the probe being fairly in the cavity, the staff was withdrawn. The operator next took in his hands two conductors, a sort of strong iron probes, the one (named the female conductor) having in it a groove like that of our common directory, the other (the male conductor) having a probe point, corresponding with that groove; and the grooved, or female conductor, being passed along the probe and lodged in the bladder, the probe was withdrawn, and the male conductor passed in its turn along the groove of the female conductor, till both were lodged in the bladder, lying alongside of one another. Then commenced the operation of dilating. The lithotomist took a conductor in each hand, and by diverging their shafts, dilated, or, in plain language, tore open the prostate gland.

Thus was the wound stretched by the conductors, that it might admit the dilator, which was an instrument resembling forceps, whose points, by a sort of double hinge, diverged and opened in proportion as the handles were pressed together. The dilator being passed betwixt its two conductors, was pressed into the narrow wound, and the conductors being held fast and steady, the operator began to act slowly with his dilator, and, by regular and successive strokes, continued to stretch the wound till he was sensible it could admit the forceps. Then the dilator was, in its turn, withdrawn; the great forceps pressed in betwixt the conductors were wrought forwards with a rotatory motion, till they passed into the wound; then they were turned round and round in the bladder, till they lay freely in the bladder, so that the operator could open them for the purpose of grasping the stone.

These rules for performing this operation are delivered by Marianus in such pleasant terms, that nothing presents itself to the imagination of the reader, but a succession of easy operations; the probe gliding smoothly along the staff! the conductors along the probe! the dilator along the conductors! and the forceps last of all. It was not till new and more successful operations were invented, that the cruelties or dangers of this one were brought to light. Marianus plainly intended to write nothing but in the way of eulogium concerning that operation, which he contrived should be called by his own name: nothing is said of the lingering sufferings or piteous cries of his patient; his hyperboles he reserves for the praise of his irresistible instruments; he speaks of no courage but that of his gaping dilators, nor of any cries but those of his vociferous forceps;—but after ages told another tale.

The book of Marianus contains the oldest description we have of an operation which maintained its place for some hundred years, and lost during all the period none of its horrors. Paræus was the immediate successor, or rather the contemporary of Marianus; and, in his time, the cruelties of the apparatus major having become only more systematic and orderly, we can from his text supply whatever is left defective in that of Marianus. I believe that the dilatation performed by these operators might fairly be divided into three successive stages. First, such a degree of dilatation accomplished by the diverging and drawing asunder of the male and female conductors, as to admit the dilators. Secondly, such a degree of dilatation accomplished by the dilator, the most cruel of all this apparatus, as to admit the forceps. Thirdly, a dilatation accomplished by turning the forceps, in all possible directions, till the operator found room to turn them freely in the bladder in search of the stone, which was extracted by continuing to turn them from side to side. Paræus dilated, more than other surgeons, with the forceps; first he introduced his conductors, which were, indeed, essential to the introduction of the forceps; then the duck-bill forceps were thrust, with violence, betwixt the conductors, into the cavity of the bladder; "then the forceps were opened with both hands, turning them forcibly at the same time from right to left, this way and that way, to dilacerate and enlarge the wound."—"Puis l'ouvrir de deux mains, les tournant à dextre et sinistre, çà et là, pour dilacérer et aggrandir le playe." "And next, Paræus when he could not prevail, and it was necessary to dilate the wound still more largely, betook himself to the instrument named dilator." But every successive step of the operation excels the preceding one in ingenious cruelty; the latera or sides, which are described by Marianus as assisting the forceps (when they have roared in vain), are plainly and simply described by Paræus, under the name of ailerons or wings. They are used as assistant forceps; but the forceps filling up the wound, and the operator unwilling to lose his hold of the stone, the two latera were passed by the sides of the forceps, and locked upon the stone, so that the whole resembled a four-bladed forceps; but with this peculiarity, that the latera or assistant forceps were so hinged upon each other, that upon clasping the handles, the points closed, and the hinges at the same time rose, so that the instrument served at once the double purpose of dilators and assistant forceps. That the cruel manner in which the general operation was performed may be fully understood, I have here given a plate of those dilators.

Yet none of the direct rules for performing these cruelties make so strong an impression upon my mind, nor so plainly prove the cruel nature of the invention, as the accidental disputes about the use of the dilator. Next to Marianus and Paræus came the family of the Collots, who practised this dilatation with great assiduity, and affected particular dexterity in the use of the dilator. They had been famous lithotomists for eight generations, during all which period they had kept their operation a secret, till, at length, a book was found in the closet of the elder Collot, written in his old age, after he had ceased from the labours of his profession, containing an authentic history of his operation. This man was contemporary with Paræus: he had been elected royal lithotomist (the first who held that title) under Henry II. of France: his operation, which he had learned of a lithotomist of the name of De Ville, was plainly the Marian operation, with no peculiarity, that I can perceive, unless it be the peculiar dexterity with which he affected to use the dilator, though little credit surely can be given to any report of a mysterious and cunning way of using an instrument which can plainly do nothing but lacerate, and that rudely.

The occasion which excited Collot to defend the use of the dilator is this:—The gorget was first invented in the time of Collot; it was not, during many centuries, a cutting instrument, but merely a blunt wedge, a scoop of a conical form, which, from the form of its beak, slipped easily along the groove of the staff, and by its wedge-like shape dilated the wound, and by its groove or hollow served as a conductor for the forceps. "I do not deny," says Collot, "that those who refuse to use the dilator may find themselves successful with the gorget; the gorget may be a commendable invention: but this I will say, that those who thought it necessary to invent the gorget must have understood very little the way of using the dilator; for the use of this instrument may be regarded as a sort of secret in the art not to be acquired but by being taught." "L'usage de cet instrument pourroit passer pour une espèce de secret difficile à pénétrer sans une instruction particulière on ne doit dons pas abandonner le dilatoire.—L'usage du dilatoire est tout le secret de nôtre operation; il disposé l'orifice de la vessie, qui est naturellement très serré, au relachement; il vide à manier les autres instrumens."

In short, dilating was the essential circumstance in the operation, and Collot plumed himself upon the dexterous use he made of the dilator. He was profuse in his praise of an instrument, the use of which he regarded as peculiar to his own family. "It is," says he, "our whole secret in operating; it is by the dexterous management of this instrument that we get the free use of all the others; it forwards the dilatation of the cervix vesicæ, and a little reflection will persuade us, that the affair has been misrepresented! The dilator is indeed painful in its introduction, but it is a pain which lasts but for a moment, and is to relieve the patient from the more excruciating torments of his disease."—Page 314.

There is one precaution repeatedly inculcated by Marianus and others, which demonstrates, in a particular manner, the violence with which this dilatation was performed, and it is this :—" That while the dilator was passed betwixt the male and female conductors, it was necessary to hold them perfectly steady and firm !" What does this mean ? why, that the dilator was forced in betwixt the conductors or grooved probes with such violence, that if they were not held perfectly firm, they were in danger of being carried forward along with the dilator, and driven through the very fundus of the bladder. " A surgeon, little skilled in the operation of lithotomy, called together some of his friends, surgeons and physicians, and among others Saviard (who relates the fact), to witness an operation. Although (says Saviard), it is not only necessary to keep the conductors steady, but in some degree to retract them while the dilator is pushed onwards, this unfortunate surgeon pushed on his dilator into the bladder, regardless of what might happen ; allowed the conductors to be pushed along with the dilator, and they pierced the fundus of the bladder. The surgeon had the good fortune to catch the stone before it escaped through the rent into the cavity of the abdomen. But while he was extracting the stone, a piece of flesh protruded, which he (letting go the stone), reduced with his finger, and would again have introduced his forceps, but that Saviard, conscious of what had happened, prevailed with him to refrain. The little girl on whom this operation was attempted, being put to bed, died in great agonies on the fourth or fifth day.

"Upon opening the body, the conductors were found to have pierced the bladder at its fundus, the opening being such as might permit a hen's egg to pass through it. In trying a second time to extract the stone, the forceps, stone and all, had been driven through the rent, and the soft stone giving way under the pressure of the forceps, was found crumbled in the cavity of the abdomen. The spongy piece of flesh which they had seen protruding through the wound was a part of the ilion." This explains but too well the use of those little chains and cross pins which are drawn at the conductors of Paræus, for the cross pins were passed through the holes to prevent the conductors being pushed too deep. The conductors of Joannes de Romanis Marianus, and others, were guarded by cross handles, like that of a Roman sword.

One circumstance more gives us a terrible conviction of the cruelties of this operation; it is the use of the canula. In truth, the wound of the Marian operation never healed; it continued, in four out of five cases, fistulous for life; and the immediate discharge from the bruised and lacerated parts required to be conveyed away, as from the cavity of an abscess, by a tube. In the old method of amputating limbs, the surgeon allowed the arteries to bleed, ostensibly to prevent plethora, but really because he could not stop them. In the old way of lithotomy, they introduced the canula into the wound, ostensibly to prevent healing, but really because they could not heal the wound. They were exceedingly at a loss for respectable reasons in favour of the canula. Collot affects to quarrel with Frere Jaques for healing the wound too early: "This man," says Collot, "were he but learned in anatomy, and sufficiently honest, would acknowledge the danger of healing up the wound too early: wounds of the fleshy and muscular parts may indeed be closed, because they heal from the bottom, but not so in wounds of the bladder, where you unavoidably leave a cavity behind. The wound (says Collot) must then be kept open with the canula: First, for fear of suppression of urine, in consequence of a precipitate cure; suppression of urine being a natural consequence of what the cervix suffers during operation, (qui se fait au sphincter par le travail de l'operation). Secondly, it is necessary, instead of immediately healing up the wound, to allow a due time for the suppuration of the wounded parts, and the recovery of the bladder, after the long pressure of the stone. Thirdly, the patient would be in a very critical condition indeed, were there no outlet preserved for the escape of whatever fragments and particles are broken off the stone by the forceps. Fourthly, it is necessary continually to cleanse and purify the bladder from the feculences and discharges which are collected in greater or lesser quantity, according to the period during which the patient may have laboured under the stone; and it is occasionally necessary to clear the bladder of fungous and other tumors, which often torture the patient till he dies." That the patient often died, and that his bladder, when he survived, was slowly purified, I sincerely believe; but, in truth, they were often altogether unable to extract the stone through the narrow wound made in operating with the apparatus major; the canula was left in the wound as a channel for the urine to pass off by; and the canula, by preventing any fulness of the bladder, or any action which might make it compress the stone, did in some degree assuage the pain *.

Le Dran speaks, like Collot, in very familiar terms not only of leaving the canula in the bladder, but even of leaving the stone. "If in order," says Le Dran, "not to fatigue a distempered bladder, it be judged proper to leave the stone there, as I have seen done by a great man of our age, who, in this case, waited till the bladder was relaxed by the suppuration to make the extraction; the passage remains always open and easy to introduce a forceps." This is the "Operation en deux temps," i. e. leaving an interval betwixt the incisions and the extraction of the stone, which has been boasted of, like many other antiquated conceits, as an important innovation.

Even in the time of Collot, men began to revolt from the use of the dilator: and such were the cruelties of the whole apparatus, that the moment Frere Jaques appeared (who, though rude and ignorant, was the first who taught us those bold and masterly incisions which the operation requires), all men turned to him, and he was followed by Raw, Chesselden, and all the great surgeons and lithotomists of that age. Yet it must be confessed that there remained, for many years, a leaven of the old school; the staunch old defenders of the apparatus major died out, but

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* The canula is of the greatest use in preventing extravasation of urine, but it should not be kept longer than twenty-four hours in the wound.

they left behind them a sort of neutral corps, who had, in their younger days, been taught this operation of the apparatus major, but had not yet performed it professedly, nor found their own reputations connected with the fate of it. They seemed inclined even to deceive themselves, by retaining the forms of the old operation, while they essentially performed the new. They began, indeed, their operation, as in the old way, by cutting low in the perinæum, and opening only the bulb and membranous part of the urethra; but they finished by running the knife forward and cutting the prostate gland. This last motion of the knife, by which they slit up the prostate, they thought fit to describe as singularly mysterious, and they called it the coup de maître, or cunning stroke! Such was the paltry device by which they reconciled their old faith with their new practice; they slipped in the knife, unobserved by the spectators, and cut more than they chose to confess: they satisfied their conscience by performing something like the right operation, and saved their reputation by appearing to perform the wrong one; they affected that mysterious dexterity which professed lithotomists have found so profitable in all ages.

Among the most conspicuous of this neutral corps was the famous Le Cat, a lithotomist of Rouen, in Normandy, whose writings develope all the principles of those who professed the apparatus major. He was a man of as singular defects and excellencies as ever fell to the lot of one individual: he had as a polemical writer rapid conceptions, address in argument, and a neat and eloquent style; talents for mechanical inventions he certainly possessed, and he had an un-bounded passion for curious instruments and complicated operations. But these excellencies were counterpoised by defects of a most dangerous tendency: he was ambitious of being regarded as an original inventor, and would not condescend to perform an operation which was not peculiarly his own; his notions on the most important points in surgical pathology were very perplexed; and his correct knowledge of anatomy he perverted to the most absurd purposes; he was altogether defective in sense, steadiness, and sound judgment: he persisted in operating, during all his life, with knives of the most uncouth forms, and an apparatus extremely complicated, and which he was changing from day to day. He was so infatuated, that when his friend and kind master, Morand, after returning from England, put the simple knife of Chesselden into his hand, and taught him to use it, he said it was naught, and returned to his own crooked armoury: he persisted in proving, very eloquently, that dilatation was the most commendable way of operating, after the conviction had come home to his own mind, that incision alone was safe! after it had become, indeed, his practice! for he actually divided the prostate; and that movement of the lithotome, or knife, which others called the coup de maître, he named le debridement du col de la vessie, the unbridling of the neck.

Thus it was the fate of a man of talents to write volume after volume, without making one convert, and to cut hundreds, by an apparatus so ingeniously complex, that he never prevailed, during all his life, on one lithotomist, pupil, surgeon, or even quack, to adopt his operation.

To explain the complicated operation of Le Cat belongs (if indeed so extravagant an operation can excite any interest) to another subject. His doctrines, more interesting, may be told in a few words: they have an intimate relation to the sentiments of the other great lithotomists of his time, and especially to the opinions and practices of the celebrated Le Dran. The mysterious doctrine of the dangers arising from wounds of membranous parts, is his chief and favourite theme, and it is mortifying to observe how little good faith is to be looked for, when a favourite doctrine is to be maintained, how trivial an argument, how slight an authority, how imperfect an analogy, will satisfy the dogmatist who would rather establish his own favourite theory than discover truth. Little acquainted with general pathology, the theorists of the last age confounded the dilatation of parts with their growth, and maintained, that parts may be dilated without violence, because they grow by nature. The first leading analogy they fell upon was that of the womb, which is in the pregnant state dilated (as these theorists say) to an enormous size. —No, it is not dilated, it grows, there is a real increase of matter both in the contents of the vessels and in the solid substance of the womb, which increase of matter is, after delivery, very slowly evacuated or absorbed: Le Cat might as well have adduced the growth of the fœtus from an invisible speck to a lusty child, as an instance of dilatation! Yet from such insufficient proofs did the defenders of the old operation deduce this conclusion, that nature had set no limits to the dilatation of membranous parts, as the bladder of urine, the hollow viscera, and the uterus.

"The dilatability of the hollow organs," says Le Cat, "is most conspicuous in their orifices, as is exemplified in the orifices of the bladder and womb." Le Cat and other supporters of the system of dilatation reasoned, as if there existed a real analogy betwixt the orifice of the womb, designed by nature for the most perfect dilatation (viz. that necessary for the delivery of the child), and the orifice of the bladder, plainly intended by nature for the most perfect and close contraction, such as is necessary for retaining the urine! indeed the closeness of this orifice is such as to restrain the urine, although continually pressed by a slight action of the bladder, by the pressure of respiration, and by the weight of the incumbent viscera; and this orifice, which is permanently in a state of the closest contraction, never, even during the momentary efflux of the urine, suffers any but the slightest dilatation. Such analogies, so absurd and inconclusive, must surprise any man of sound sense and judgment; but what must be his reflections when he first perceives that a theory so extravagant as this is designed as a vindication of the most cruel and unnatural practice? when he finds those theorists presuming to put their horrible operation of tearing the neck of the bladder, on a parallel with the natural dilatation of the womb? The extravagance of such reasoning never startled those theorists, nor did the cruelty of the proposed innovation alarm them; they meant, bonâ fide, to dilate the neck of the bladder, so as to permit the stone to pass, in women, without any previous incision, and in men, with only the outward incision of the skin and muscles. They did not scruple to lay down this rule in the most decisive terms, but plainly and openly avowed it as their belief, that "the bladder, like the womb, was capable of this sort of childbirth." The errors of Le Cat, an able but ignorant man, may be excused; far from being capable of establishing analogies or reasoning on pathology or the theory of surgery, he seems so ill instructed in logic that his proof of those two parts being equally capable of dilatation, because they are both orifices, must remind us of the parallel attempted by Fluellin, betwixt Macedon and Wales.

That their theory might seem less preposterous, and their practice not unnatural, they undertook to prove that they were, in fact, but repeating a very usual operation of nature, since women often pass stones of very great size, without any help; and that great lithotomists have, upon the authority of this fact, operated on women, by the apparatus major (i. e. by mere dilatation, by thrusting the dilator through their short urethra into the neck of the bladder), without using the knife.

From these misconceived analogies of the bladder, and of the womb, and the imaginary resemblance of the organs in both sexes, this cruel doctrine was inferred; that the cervix vesicæ should be dilated in true conformity with the operations of nature in like cases. "That nature must be correctly imitated, which to facilitate the passage of the child dilates the womb slowly, and by intervals, corresponding with those of the pains of labour; such, of course, should be our method of dilating the urethra slowly and gently."

Le Cat having transcribed this extravagant notion from Le Dran, exclaims in raptures, "Is not this admirable surgery! I do confess that I no sooner read the sentence than I sent the discourse to M. le Blanc, enchanted to find my sentiments corresponding so expressly with those of that celebrated surgeon."

But when these theorists had arrived at the end almost of their career, an obstacle, of no little importance, presented itself to their imagination; viz. the difference in the organs of the two sexes. "Nature, we must avow it," says Le Cat, "has set bounds to this dilatation in man, by the firmness of the prostate gland, with which nature has encircled and fortified the entrance of the bladder. Yet even this gland, and its follicules and sinuses, are susceptible of dilatation in some degree; and the lithotomist, when he ventures to undo this obstacle, by a small incision in the prostate, makes way for a free dilatation of the bladder itself." Thus their proud theory of dilatation ends plainly in incision, and the dividing of the prostate gland, which others named coup de maître, is named by Le Cat and Le Dran débridement du col de la vessie: thus did they deceive themselves and impose on others by a change of names.

There wanted but one argument more to complete the proofs of Le Cat's doctrine; viz. that he should be able, after so many bad arguments, to adduce some unlucky operations done with the knife: this was perfectly easy; he had but to make the experiments himself, and with his own knives, and even this he condescended to do in compliment to his favourite theory. It will be recollected that his kind master, Morand, had, upon his return from England, put the knife of Chesselden into his hand, but Le Cat refused his instructions; he did, indeed, perform the operation of Chesselden (not with Chesselden's knife, but his own), unwillingly and awkwardly, no doubt, on nine patients, in the Hotel Dieu; of these nine patients six died, and this infatuated man ventured to produce publicly the ill success of his own mal-adroit operations, as a proof of the danger of wounding the neck of the bladder! there was no contending with one who could bring such damning proofs *.

Le Cat, by all his reasonings and experiments, imagined that he had established the following conclusions: that wounds of membranous parts were mortal, and that dilatation of membranous parts, as of the urethra, bladder, womb, is safe if slowly performed: that since dilatation is less dangerous than incision, that which is less dangerous should predominate; we should make our way therefore into the bladder more by dilatation than incision: that, in short, lithotomy should consist of incision and dilatation combined; little incision, much dilatation, and no laceration. Such are the definitions and principles of his own peculiar operation, which, if not directly announced in any one passage, may,

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* "L'incision intérieure coupoit le dedans de la prostate, le col de la vessie, et environ un grand pouce, ou un pouce et demi de son corps. Elle n'intéressoit, ni le rectum, ni aucune autre partie respectable. Confirmé par ces essais, je me résolus d'ajouter ce nouveau degré de perfection à nôtre méthode.

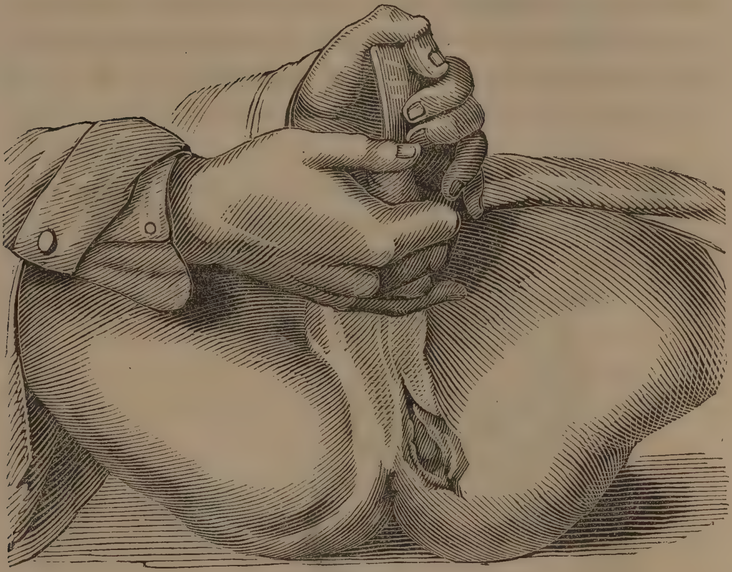
"Le 7 Mai 1735, je taillai avec ces instrumens quatre sujets en huit minutes; le premier Juin, cinq autres avec la même aisance: de ces neuf sujets, quatre sont morts dans la huitaine, deux après le quarantaine."

at least, be collected from his illustrations and reasonings.

But my reader cannot be without some desire to know what the words were of this boasted aphorism, by which those innovators maintained their theory of wounds in membranous parts being mortal. Hippocrates says, in his 18 Aphor. sect. 6. "Vesica decissa, aut cerebro aut corde est lethale." What is this? Is it authority for avoiding or preferring any thing particular in lithotomy? By no means; it is merely a general prognostic concerning the danger of wounds of the viscera; and whoever had made himself acquainted with the writings of Hippocrates, or remembered the promise he exacted of his pupils, never to cut for the stone, might have predicted that those who searched into the works of Hippocrates for authority on such a subject would be obliged to content themselves with some vague and general text. This is the sole authority that Le Cat has ventured to quote: after some abortive attempts to reconcile the practice of Celsus, who directs deep incisions, with the supposed precept of Hippocrates about membranous wounds, he concludes his reasoning with an argument unanswerable in his days, and requiring no answer in ours. "Toute l'antiquité a suivie ces grands hommes."—"All antiquity," says Le Cat, "has followed these celebrated men," and he intended, no doubt, that all posterity should follow in the same path.

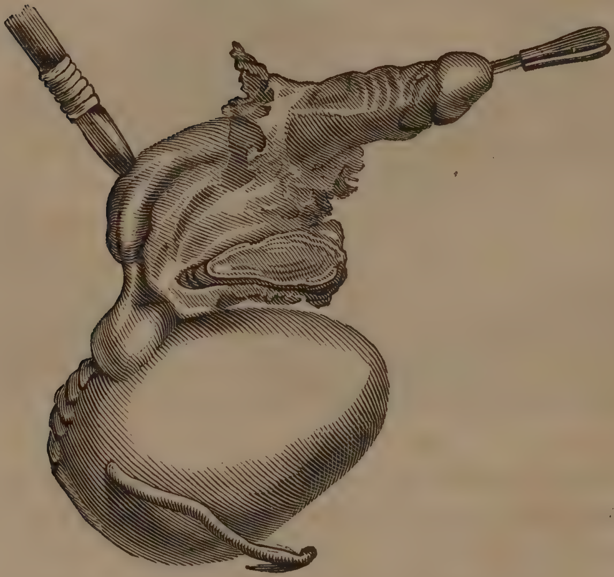
These are not unimportant debates; every theory in surgery involves (as this certainly involved) the lives of thousands; and the manners, the learning, and the operations of the profession, in that age, may afford useful lessons to modern times.

ANATOMY OF THE APPARATUS MAJOR.



Let us, in order to profit by the mistakes of our predecessors, put this operation also to the test of anatomy.

First, as it was the design of these learned lithotomists not to cut, but dilate the bladder, their incision did not pass the anus or tuber ischii; did not extend to the hip; did not lay open that great hollow by the side of the rectum, in which the neck of the bladder is felt by the finger, and through which alone the stone can pass easily: their incision hardly reached the anus, it hardly extended indeed beyond that point where ours begins: they cut only the perinæum where the bulb of the urethra lies: they did not penetrate to the neck of the bladder, they slit up merely the bulb of the urethra*; the danger of wounding membranous parts was the main theory of their operation, wherefore they reserved the membranous parts of the urethra along with the neck of the bladder, to be torn by the force of dilators†.



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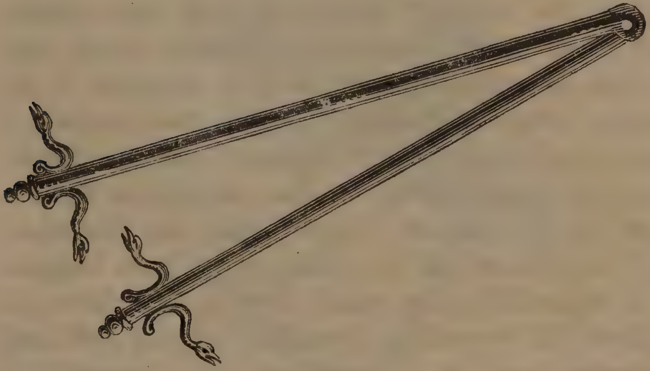
* The cut represents the knife entered above the bulb; it must consequently be carried a long way before it reached the bladder.

† "In the grand apparatus the urethra is cut by the lithotome at its bending, and the incision ends almost an inch and a half on this side the prostate. What composes the rest of the stone's passage is the bulb of the urethra, which is aponeurotic." Le Dran.

"Ce qui me fait croire que la plus grande difficulté qu'ont les plus habiles lithotomistes à tirer la pierre, vient moins souvent de la part du col de la vessie, que de la part de l'uréthre, parce que

That the membranous part, the narrowest and most delicate part of the urethra, should be dilated without being torn! dilated, so as to allow the stone and the great forceps to pass along the canal, is a thing so incredible that there cannot remain the smallest doubt that by those who operated with the apparatus major, it was lacerated to very rags and tatters! And after it was so lacerated, the same dilators were advanced deeper into the neck of the bladder, and new lacerations begun.

Now, it is neither the needlessly slitting up of so great a length of the urinary canal, nor the extensive wound of the bulb, nor the profuse hæmorrhage from its cavernous body, that we have to remark; but this



ne coupant l'uréthre, comme ils font, qu' au devant des os pubis; et le col de la vessie étant placé au derriere de ces os, il reste d'ordinaire sous l'angle qu' ils forment par leur union, un pouce ou environ du canal de l'uréthre qui n'a point été coupé à traverser. Or ce canal étant plus étroit que le col de la vessie; il y a donc bien plus d'apparence que la difficulté qu'ont tous les lithotomistes à tirer la pierre, vient moins de la part du col de la vessie que de celle de l'uréthre." Mery, p. 68.

The plate represents the dilators of the apparatus major.

was particularly lamentable, that the urethra being torn to rags in this way of operating, never could regain its form, but wasted in suppuration, so that the patient had an incurable fistula, with impotency, the urine and semen issuing by the perinæum.

Secondly, the new lacerations here mentioned above, are those of the neck of the bladder and prostate gland; and to conceive truly of the effects of this second dilaceration, we must reflect on the state of the parts. The urethra was lacerated, torn even to the apex of the prostate gland; Le Dran, himself the supporter of the apparatus major, confesses, on various occasions, that this membranous part is incapable of dilatation, that it tears when forced by the conductors; that it is rent on that side which lies against the rectum *. Imagine then this delicate part of the urethra rent: the male and female conductors passed through the ring or stricture of the urethra into the bladder: imagine the handles of those conductors farther diverged: imagine the dilator, the gorget, or the forceps, wedged in betwixt them for the purpose of completing the dilatation, and you will be able to predict what must happen. It is impossible to use much force in one direction, without its operating (especially among soft and moveable parts) in all directions! it is impossible to dilate, or attempt to dilate the gland, without pushing it back! and when the gland is thus forced back into the pelvis, while the urethra, already lacerated and incapable of resistance, is retained by its con-

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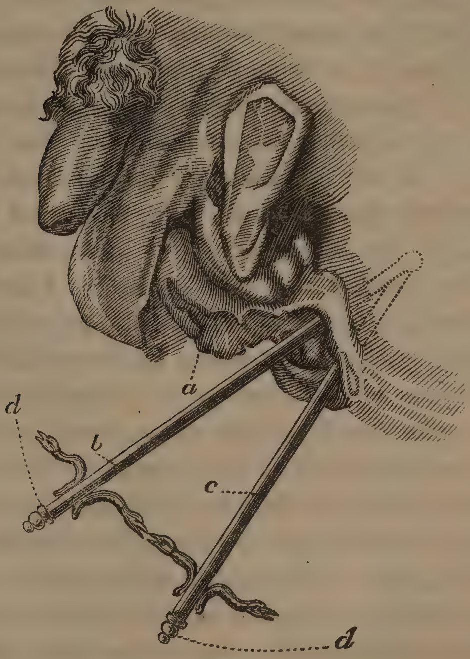
* Whichever of these methods is chosen to make the dilatation, it cannot be accomplished without opening the whole canal along the side of the rectum. Le Dran.

nexion with the os pubis, what can save it from being entirely separated from the bladder? The diverging of the conductors, the driving in of the gorget, the strokes of the dilator, the stretching of the chops of the forceps, all tend to separate the bladder from the urethra; even the boring the finger into the firm ring of the prostate might occasion this separation: in a long and violent operation with the apparatus major, it is merely impossible that this part of the urethra should escape.



Thirdly, This terrible consequence of the second laceration is demonstrated by the third drawing, which represents truly the condition of the parts. The bulb is slit up by the incision of the knife; the incision is continued in the laceration, which extends the whole length of the membranous part of the urethra; the laceration of the prostate, the part next in succession, is represented, as it always must have been, very irregular; and the almost total separation of the urethra from the bladder is also seen, where only a few threads and fibres of the cellular substance are seen remaining entire. Nor is this hypothetical merely, the fact is proved by every kind of evidence. In all the experiments of Le Dran, who dissected bodies to discover the consequences of each method of operating, the prostate gland was found (when he dilated with the apparatus major) to be severed from the urethra, by the labouring with the dilating instruments. All the reports of Mery, Le Cat, Saviard, and others, who dissected those who had died after the operation of the apparatus major, confirm the fact. The prostate gland was as fairly separated from the urethra, by the violence of this rude dilatation, as when the urethra was cut across by Frère Jaques, and others, who operated by the gripe without a staff: nor is there one writer in favour of the apparatus major, so dishonest as to deny that incurable fistulas were the frequent consequence of it; even Le Dran confesses it in these terms: "It is likewise true that some patients have remained fistulous; but this never happens but in two or three cases, as when there has been a very great dilaceration; when to extract large pieces of a broken stone, or to make a distempered bladder suppurate, they have been obliged to leave a canula long in the bladder; or in fine, when the patients have been much wasted during the course of their cure."

Fourthly, If there was difficulty in getting into the bladder, by the dilating instruments of the apparatus major, there was still greater difficulty in extracting the stone. The easy extraction of the stone depends not on the free incision of the prostate ~~bladder~~, or glan other internal parts, but on the proper dissection of the external parts, for which there is one great and invariable rule.—"To cut fairly across the transversalis or triangular muscle which bars the perinæum," a short incision, such as was used in the apparatus major, an incision, I mean, which falls short of the middle point, betwixt the anus and the tuber ischii, is not only insufficient as it is short, but undilatable, as it is bounded by the transverse muscle, still undivided. In the old operation, their outward incisions were made almost as timorously as their internal incisions; and the delivery of the stone, when actually seized by the forceps, was a third stage of dilatation more difficult than even the introduction of the dilators; for, with the dilators, the comparatively delicate parts, the urethra and neck of the bladder alone, were forced, but with the forceps, the muscles of the perinæum, which can hardly be made to yield, were to be dilated.

This point, which bears perhaps a more interesting analogy to our modern operation than any other circumstance of the old one, I have thought it right to illustrate by figures 4, and 5, where both the place and the effect of this incision are clearly expressed. The incision, in numb. 4, is the true incision of the old lithotomists, and such as but too many modern surgeons are apt to make; it hardly passes the anus, or passes it superficially in the skin, while the parts within are not divided, and the perinæum continues bridled and constricted by the transversalis perinæi (a), fig. 5. The incision reaches that part (b) of the great hollow opposite to which the membranous part of the urethra lies, but not the part (c) of the cavity of the pelvis, opposite to which lies the neck of the bladder and body of the prostate.

I will take this fair anatomical scheme, as my warrant for affirming, that if the apparatus major was, as Heister says, " A base and self-interested invention !" it was, at the same time, the most cruel and horrible that ever entered into the heart of man to conceive; the proofs of this may be found in every circumstance already related.

This laborious, and sometimes unsuccessful operation, lasted not unfrequently for an hour, amidst the agonies of the patient and the ineffectual struggles of the surgeon. The greatest masters assure us, that the chief difficulty lies in dilating, and the most consummate in this art of dilating, dilated slowly, fibre after fibre, till the finger, or the forceps, could be admitted into the ring or stricture of the gland. Collot, and those who affected to perform the most perfect operation, regarded the right management of the dilator as the chief secret in lithotomy, and accused the ignorant of tearing, only because they knew not how to dilate, fibre after fibre. Le Dran, with the perfect composure of a philosopher, calculates the degree in which the dividing of the points of laceration, by dilating slowly, lessens the pain. " The incision of the urethra is," he says, " unquestionably prolonged into the neck of the bladder, but every line of the canal is separated one after another, and thus one very acute pain is divided, into so many lesser pains as there are points of dilatation." Such sophisms were but slender consolations to those who were thus put to the rack, " for who can hold a fire in his hand, by thinking on the frozen Caucasus?" To all their cold-blooded apologies for this cruel dilatation, the plain words of Dionis give the lie; he was himself an operator with the apparatus major, yet could not find in his heart to disguise the truth: "It must be acknowledged," says Dionis, "that while we give those two strokes of the dilator lengthways, and crossways, we hear the patient redouble his cries, and cannot but be sensible of the pains he suffers, and of the propriety of refraining from the use of this instrument as much as possible *."

Morand had also been an operator with the great apparatus; but having been deputed, by the French academy, to go to England and learn the operation of Chesselden, it became his interest, after his return, to disclose the secrets of his hospital, and this is the authentic and melancholy record.

Authentic list of the operations in the Hospital of La Charité.

Anno 1731, 14 cut for the stone	-	8 died.
1732, 11 cut for the stone	-	4 died.
1733, 16 cut for the stone	-	8 died.
1734, 17 cut for the stone	-	9 died.
1735, 13 cut for the stone	-	9 died.
Total, 71 cut for the stone		38 died.

Such was the issue of this operation when performed in La Charité, by Mareschall, Morand, and others, the first master surgeons of Paris, a city where the place of hospital surgeon having been always filled by the most eminent anatomists, operations have been performed in a manner which, till the time of our great anatomist Chesselden, never had been excelled.

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* "Et véritablement dans le tems qu'on donne les deux coups du dilatatoire, l'un en large et l'autre en long, on entend le malade redoubler ses cris; ce qui prouve l'exces du mal qu' il ressent pour lors, c'est pourquoi on conseille de s'en servir le moins qu' on pourra."

Who the person was that published the works of Collot, I know not; but he, in publishing the history of the apparatus major, as it was found in the closet of old Collot, would not surely dare to traduce the first surgeons of France, nor obtrude upon the world untrue reports from those hospitals in which all the surgeons of France had learned and practised their profession. He speaks, in his preface, like one who had felt all the horrors of this operation, and called upon the public to witness the truth of his reports. "The small proportion of patients," says the editor, "who survive this operation, will render it for ever formidable! of twenty, cut by the apparatus major, not five are saved! and those who do survive pass a melancholy life, for fistulas and incontinence of urine are the usual consequences of the incision."—"Look but to the books of La Charité," says this anonymous editor, "and you will find almost all the patients dying in a few days: in the year 1725, of twenty cut for the stone, five only survived! The farther we search into these registers, the more fully shall we be persuaded that there is no period which is not marked with the same mortality, nor do the registers of the Hôtel Dieu afford us the slightest consolation*."

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* "Le petit nombre de ceux qui survivent à cette opération la rendra toujours redoubtable; de vingt malades à peine en sauvent ou cinque ou six; l'opération même ne leur laisse qu' une vie triste; l'écoulement d'urine, les fistules, sont les suites frequentes de l'incision." Page 12.

In another passage, page 42 of the preface, the editor says, How greatly those deaths were aggravated by the manner of them, it is easy to conceive. The scene exhibited in a great hospital was terrible, where all kinds of dilators were at hand, and were freely used; where very often, as Le Dran confesses, the operator laboured with a degree of violence in which the safety of his patient was not the principal object, "where vanity suggested to the operator, the desire of finishing his operation almost as soon as it was begun." Sometimes the operator attempted to succeed by separating the handles of the conductors, or boring his finger between them: sometimes by driving in the gorget through the prostate gland: sometimes by working with his finger in the hollow of the gorget, and turning and twisting it, to enlarge the opening: sometimes, by driving the forceps rudely along the cavity of the gorget, or betwixt the handles of the conductors, and, twisting, turning, and separating their handles, that they also might serve as dilators. But when all failed, and the operator was forced to quit his hold of the stone, and use the proper dilator, when he made successive strokes with this instrument, first longways and then across, the tortures of the patient were not to be endured, and notwithstanding "the division of this acute pain into so many lesser pains," the halls of the hospital resounded with his cries! Yet why should I attempt to represent a regular succession of dilatations or of instruments, since the instruments were used pro-

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" Qu' on consult les registres de la Charité, on verra que presques tous les taillez meurent dans peu de jours; en 1725, de vingt qui se sont livres à l'opération il n'en reste que cinque! en remontant plus loin, on trouvera chaque année marquée des mêmes malheurs: l'Hôtel Dieu n'offrira pas des moindres ravages."

miscuously? since, notwithstanding the art which some affected, their dilatation was one continued scene of confusion and violence! Every one had his own peculiar and boasted method of lacerating the parts*.

Let the modern lithotomist, if any one assuming the name of lithotomist should condescend to read this analysis, reflect on the cruelties of past times; let him ask himself this question, Have I never performed an operation too nearly resembling this in its defects, in its consequences? Are there no useful lessons to be deduced from this relation of the cruelties committed in former ages?—I fear there are few modern operations free entirely from the cruelties imputed to the apparatus major.

First, Let it be observed, that neither the passing down of the staff into the bladder, nor any other circumstance, can entirely save the urethra from the knife or forceps of a bad operator! The nick in the urethra, which should be made at once, and decidedly, is often done by a timid or awkward man at several successive strokes; he cuts, lays down his knife, lifts it and cuts again; and thus, by successive cross-incisions, he so mangles the urethra as almost to divide it from the prostate gland, and render it incapable of withstanding the push, even of the sharp or cutting gorget.

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* The heavy work they had in dilating the parts may be understood by the following quotation from Pallas, who reports no more than what he had himself seen in the hospitals of France: "Quando adhuc ad priora impedimenta major accedit calculi moles, maxima est partium læsio, ad quam educendam non raro plurium etiam brachiorum hominum auxilium desideratur." An operation such as this can be likened to nothing so properly as the deliveries with hooks related by La Motte and other accoucheurs of the last age, in France, who sometimes came upon the country surgeons rather suddenly, when the crotchet being fixed into the head of the unborn child, the master was pulling by the hook, and the servants and apprentices pulling by the master. I have had the advantage of seeing such examples both in lithotomies and accouchemens.

Secondly, That the modern lithotomist, by not opening the urethra freely with the knife and by using a narrow-bladed and conical gorget, often cuts the prostate gland so imperfectly that it admits the forceps with difficulty, and in pushing in the forceps, the mangled urethra gives way.

Thirdly, Sometimes I am persuaded it happens, that the prostate being thus severed from the urethra, in the modern, as in the ancient operation, or the gland imperfectly cut, the forceps not being properly passed into the bladder, are pushed onwards betwixt the bladder and rectum, and the operator gropes for the stone, or actually seizes it in vain, the coats of the bladder being interposed betwixt the stone and forceps.

Fourthly, It is in this case only that the stone adheres. That a stone may adhere most perversely to the bladder, so as to be inseparable by the power of great iron forceps, is a doctrine, which, however contemptible in the eye of reason, is respectable in point of antiquity: and the doctrine once established by learned reasonings and still more learned quotations, was universally approved of for wise and useful purposes: for whoever professed this doctrine could never be abashed; he had an apology for every misadventure and the privilege of telling the friends and spectators of this operation, when the stone could not be extracted, that it adhered. Perhaps it will be well to declare once for all, in this place, the manifold causes of the adhesion of the stone. Among the older surgeons, in the time of the apparatus major, the chief cause of the adhesion of the stone was—an imperfect dilatation! And among the moderns, whenever the surgeon allows his staff to slip out through the slit in the urethra, and lie betwixt the rectum and bladder! when he cuts the urethra so imperfectly, that the beak of the gorget never is admitted into the groove of the staff! when, by pushing in a wrong direction, or at too acute an angle, the beak of the gorget runs off from the groove of the staff, and is lodged among the cellular substance of the rectum! when the forceps having been once in the bladder, have slipped from the stone, and been pushed, in the second attempt, betwixt the bladder and rectum! the stone infallibly adheres, for the bladder is betwixt the stone and the forceps. These are, I believe, the true and veritable causes of the adhesion of the stone; before I could allow myself to write, in these terms, of a doctrine once well respected and as yet hardly relinquished, I must have been resolved, from reason and much experience, to treat so mean an apology with supreme contempt, as indeed it has been treated long ago even by Collot, who performed only the Marian operation. It would be difficult to say what kind of adhesion could subsist betwixt the human bladder and the stone; yet the doctrine is one which will always be held in reverence by bad operators, uncertain of the issue of their operations. Let them, however, beware of what once happened to the profession. Lithotomists had, at one period, very nearly overshot the mark! so strongly had they impressed this doctrine, and the fear of adhesion of the stone on all ranks and degrees of people, that those even who were the most cruelly tortured with the disease refused to be cut, lest the stone should adhere inseparably to the bladder, and they suffer the pains of the operation in vain * !

Fifthly, Of all the faults of the apparatus major transferred by bad operators to the operation of the present day, that of a limited incision is at once the most frequent and the most dangerous. The manner of cutting low upon the perinæum, which should be peculiar to the operation by the apparatus major was so long exhibited in public operations, that it has hardly been disused even in modern times: those who had usually seen the stone extracted by a small incision had not the spirit to deviate from the practice of the old school, nor the boldness from principle unsupported by precedent, to make that long and deep incision which is alone safe. It is indeed to be lamented that surgeons do very often, like the sons and nephews of Collot, follow the form and steps of a traditional operation which they have learned and practised, not according to the rules of science, nor by being perfectly acquainted with the design of the operation and the dissection of the parts, but by imitating the motions they have seen performed by others! But, like the monkey imitating the operation of shaving, they have the ill luck sometimes to turn their instruments the wrong way! Marianus and his followers made the incision for lithotomy, not over the hip, but along the perinæum! so sometimes does

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* "L'idée terrible de l'adherence de la pierre, frappe et trouble si cruellement les malades, que plusieurs préferent à la lithotomie le chagrin de périr dans leurs plus cuisantes douleurs." TOLLET.

the modern surgeon: Marianus and his followers bored in the finger along the gorget, for the purpose of dilating! so does the modern surgeon, though he has no such purpose (viz. of dilating): Marianus and his sect turned and wrought the forceps in the most unrelenting and cruel manner, for the purpose of completing the dilatation! so does the modern surgeon; though his free incisions should enable him to refrain from this cruelty; he has indeed no design of dilating with the forceps, and merely performs certain manœuvres which he has seen practised by those who preceded him, and which he unthinkingly imitates, without regarding the design or effect of what he does. Those rude movements of the forceps, the most cruel, torturing, and dangerous part of the operation by the apparatus major, are continued to the present day; often we see the lithotomist twisting and pulling "this way and that way,"—"çà et là," according to the express directions of Paræus; it is a method mightily affected by unskilful surgeons, who think to demonstrate to the spectators, the difficulties of the operation and their own dexterity and coolness.

If, indeed, modern surgeons were conscious that they had not divided the parts by incision, but were labouring to enlarge the wound by laceration with the forceps, according to the rules of the Marian operation; if they were guided by the theory of Le Cat, of "little incision and much dilatation," they could not have a worthier master than Paræus! but a just and well proportioned incision, according to the modern theory of lithotomy, should prevent all such difficulties. When, at any time, you see an operator struggling with the stone, turning his forceps, and twisting his body, fixing his sturdy feet against a great operation table, then wiping the sweat from his forehead, and affecting composure, amidst the cries of his patient, and the pale and haggard looks of the spectators! be assured that he is performing a Marian operation, that his incision is too small, that he has not estimated the stone and provided for its easy extraction, and that the dilatation which was accomplished among the old lithotomists by appropriate instruments, he is attempting with the forceps. When I have witnessed such an operation, I have recollected the scenes of the Hôtel Dieu and the descriptions of the apparatus major, and have thought, that were Collot to rise from the quiet grave, he would believe he saw the surgeon performing his own favourite operation, despising the method of cutting the prostate gland, dividing the muscles of the perineum, and other novelties, which began to be obtruded upon the world about the time of his death.

BIOGRAPHICAL SKETCH OF THE CELEBRATED FRERE JAQUES, AND OF HIS OPERATIONS.

It may be easily imagined that new and interesting sensations were impressed upon the public mind, when, in the Hôtel Dieu, where, for centuries, nothing had been exhibited but the lingering cruelties of the apparatus major, where professed lithotomists laboured for hours, amidst the outcries of the patient, to extract the stone! an operator appeared, daring beyond all belief, making light of that operation which had been regarded as the master-piece of surgery, who, without hesitation or fear, performed by incision what had hitherto been attempted only by the force of repeated dilatations! who boldly plunged his dagger-pointed knife into the hip, thrust it home into the bladder, felt with it for the staff, then enlarged his incision upwards and downwards, and in a few moments extracted the largest stone.

Such a man was Frère Jaques. He first broke the spell of that renowned aphorism, which declares that wounds of membranous parts are mortal; and roused the learned lithotomists and physicians of Paris from their vigorous slumbers: though ignorant in the eyes of these learned physicians, he first taught them by his success, how to explain that text of Celsus which lays it down as a self-evident truth, that in operating for the stone, "it is safer to cut than to dilate."

"Of this celebrated hermit, alternately extolled by his friends and decried by his enemies, what shall we say? intrepid and fearless, his hand never trembled, nor did his courage falter in the most unlooked for and perilous situations: modest, humble, covetous of nothing but glory, he presented himself in our city, as one sent from heaven, to alleviate the sufferings of his fellow creatures*." Eulogiums such as these, pronounced by men of learning and genius, prove that he was regarded, for ages after his death, with particular respect; and those eulogiums, repeated in all countries, mark the enthusiasm with which he was received. To us, his friends and his enemies are alike indifferent; his dispositions and his talents may now be truly estimated; and, to the memory of the man who invented that operation which we now prefer to all others, our profession surely owes every mark of respect; nor is it a vain tribute that we pay to his memory when we inquire into the history of his life; for, from his method, and the various changes it had undergone, even during his own life, may be deduced lessons highly important to the modern surgeon.

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*This elegant apostrophe I have translated from Mauchart, who, notwithstanding his scholastic manner and abstruse learning, proves himself a man of fervid genius. "De eo homine (ermita famosus) rectum non licet ferri judicium, amicis eum tollentibus nimium adversariis nimis elevantibus; manu strenua stabili nec unquam intremiscente, intrepidus animo, nec ulla inexpectata re vel difficili commotus, sobrius, spretor divitiarum, unius gloriæ cupidus, et quasi missum a Deo ad levandas hominum miserias se predicans literis commendatitiis venit Parisios." MAUCHART, page 315.

"It were to be wished," says Heister, "that we had a regular history of the life of this great lithotomist, and of his proceedings." He appeared in Paris in the month of August, 1697, habited like a Recollet (a gang of mendicant barefooted friars of the third order of St. Francis), with this variation only, that in place of the sandal of that order, he wore shoes, and in place of their cowl, he wore a hat: he had every appearance of sanctity, simplicity, charity, and all the virtues belonging to the character which he assumed, and practised all the severities of an ascetic life: he took the name Frère Jaques, and lived in Paris, the life of a hermit, subsisting merely on bread and soups: he was ingenuous, modest, simple, and very poor, accepting of no other reward than a few pence to mend his shoes, and keep his instruments in repair *."

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* "Dans le mois d'Août de l'année 1697, arriva à Paris une espèce de moine qui avoit l'habit de Recollet, avec cette différence

His name, he said, was Jaques Beaulieu, of the village of Langsauniere, in Burgundy: that he had lived in the alms-house of Besançon, where aged people and children are received: that there, and in various towns and villages of France, he had cut for the stone many times: he mentioned that he had lately travelled through the province of Burgundy, and he brought along with him many certificates of the cures he had performed. How he had learned his operations or from whom, no one could tell; the secret was indeed too important to his success to be freely disclosed: he reported, and it was received by the people, that he was inspired with the gift of cutting for the stone; and, indeed, had he not claimed a direct inspiration from heaven, he must have confessed some very humble source of instruction, for he performed other operations, and they were unfortunately the operations peculiar to quacks! Heaven had inspired him with the talent for curing ruptures and fistulas, as well as that of cutting for the stone.

Jaques Beaulieu was, when he first appeared in Paris, about forty years of age; after living an irregular and idle life, he became impressed with the most sincere sentiments of humility and Christian charity; himself an enthusiast, he had, in almost every city, excited the enthusiasm of the vulgar, who were fascinated with his peculiar dress and manners, and knew no more of his history than he chose to declare; but he could not escape the contempt of the learned,

seulement, qu'il étoit chaussé, et qu'au lieu de capuchon il portoit un chapeau. Il se faisoit appeller Frère Jaques, et il paroissoit simple et ingénu. Il étoit sobre, ne vivant que de potage et de pain. Il n'avoit point d'argent, et ne demandoit que quelques sols pour faire repasser ses instrumens, ou pour faire raccommoder ses souliers. Il s'étoit fait une religion à sa mode avec des vœux dont lui laissoit la liberté à son evêque de le dispenser quand il voudroit."

with whom a rude man affecting peculiar sanctity, and pretending to inspiration, was a character at once suspicious and odious in the extreme; and every inquiry seemed to prove, that in coursing from city to city, and from province to province, he had the address to gather up numberless certificates, by cutting promiscuously all who offered, and leaving them again without remorse. Such certificates were not refused by the friends of the patients who witnessed only the singular dexterity with which he extracted the stone; but had he waited till the time of cure arrived, the magistrates of cities would not have testified his success with so much enthusiasm*. He snatched at these certificates of success, with the greedy precipitation of a quack; and often, as in Paris, while exhibiting his testimonials, and boasting of his cures, letters arrived declaring that his patients were all dead.

It is not to be denied, that he learned his art and mystery from a quack of the name of Pauloni. His parents, who lived in the hamlet of Etendoue in Langsauniere, in the parish of Beaufort, were very poor; and he had no other education than being imperfectly taught to read and write. At the age of twenty-one years he became the servant of Pauloni, and followed him through France, during six years; when, Pauloni at length embarking for Venice, Jaques Beaulieu, either forsaken by his master, or unwilling to accompany him in such a voyage, travelled back into his own country, practising those operations at which he had hitherto only assisted.

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* "Son talent étoit d'aller de ville en ville et tailler tout ce qui se présentoit; il quittoit aussi-tôt ses malades, et les abandonnoit sans se soucier des suites; et c'est la raison pourquoi il avoit tant de ceux qui avoient été présens à l'opération, et qui pouvoient rendre temoignage de son addresse et de son habilité à tirer la pierre. Mais s'il eut attendu à les demander après la guérison, ils n'auroient pas parlé avec tant d'éloge qu'ils faisoient immédiatement après l'opération."

He had thus continued long undistinguished, by dress or manners, from those who follow the same profession. But about the age of forty years, he became impressed with the most enthusiastic sentiments of religion, and resolved to devote his life to works of charity. Although not belonging regularly to any order (or having taken vows from which his bishop gave him a conditional dispensation), he wandered over the provinces of France, and arrived, at last, in Paris, assuming only the name and character of a hermit or religious man. His air of simplicity and piety was natural and unaffected. There are, indeed, appearances which a man may counterfeit; but his whole life, and he lived to seventy years of age, was one uninterrupted scene of self-denial, while he gave, as is remarked by cotemporary authors, continual and unequivocal proofs of his liberal and benevolent turn of mind.

After travelling through the provinces of France, he arrived at Besançon, his native place. There he cut many poor people, with the happiest success, and some also of higher rank, among whom was one of the canons of the metropolitan church; who, in his zeal and affection for Frère Jaques, advised him to go immediately to Paris. He set out accordingly on this design, carrying with him commendatory letters from this clergyman to one of the canons of the church of Notre Dame, together with numerous certificates from the magistrates of the towns and provinces which he had visited. "When he arrived in

Paris, he introduced himself at the hospital of La Charité, through M. Marechal, the first surgeon; but was grieved to find that the physicians of that hospital would not allow him to operate, though he had come to Paris with the sole design of teaching a new and particular manner of cutting for the stone *." But the friendly canon had introduced Frère Jaques to De Harley, first president of the parliament of Paris, who became his friend and protector; and the interest of De Harley was of more avail than the introduction of Marechal.

We may observe, even from the first, a degree of reluctance, on the part of Mery, to become an impartial juror on this interesting question, whether this operator should be received into the Hôtel Dieu. Frère Jaques needed a protector, such as De Harley; it was not without his express command that Mery and the surgeons of the Hôtel Dieu condescended to notice the claims of this unknown operator. "I received," says Mery, "on the 7th December, an order from Monsieur the first president, to attend, in the Hôtel Dieu, an experiment of cutting a dead body for the stone, the stone to be put in above the pubis, the operation to be performed by Frère Jaques."

The first report presented to the lord president, by Mr. Mery, was equally favourable to Jaques and himself. There is indeed so much zeal and warmth in his first approbation, that we cannot but impute

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* Il se fit connoître à La Charité par M. Marechal, premier chirurgien du roy, et trouva mauvais de ce qu'il ne vouloit pas le laisser tailler dans cet hôpital, étant venu exprés à Paris, disoit il, pour apprendre aux chirurgiens une manière particulière d'executer cette opération.

his after delinquencies, his falling off from sincerity and truth, his relapsing into his old prejudices, and continuing to practise the old operation, to the jealousies of a restless and angry set of lithotomists who seduced him, and required of him a sacrifice, to which a man of spirit and honour would hardly have known how to submit. They imposed upon him the disingenuous and disgusting task of retracting his first unqualified approbation, and of inventing apologies for calumniating an operator, whom in his heart he could not but approve.

REPORT OF M. MERY UPON THE FIRST EXPERIMENT OF FRERE JAQUES, IN PARIS.

“ Having introduced into the bladder a round and solid staff, without any groove*, and of an unusual

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* “ Ayant introduit dans la vessie une sonde solide exactement ronde, sans rainûre, et d'une figure différente de celle des sondes, dont se servent ceux qui taillent suivant l'ancienne manière; il prit un bistouri semblable à ceux dont on se sert ordinairement, mais plus long, avec lequel il fit une incision au côté gauche et interne de la tuberosité de l'ischium, et coupant obliquement de bas en haut, en profondant il trancha tout ce qui se trouva de parties depuis la tuberosité de l'ischium, jusqu'à sa sonde qu'il ne retira point. Son incision étant faite, il poussa son doit par la playe dans la vessie, pour reconnoître la pierre, et après avoir remarqué sa situation, il introduisit dans la vessie un instrument, pour dilater la playe, et rendre par ce moyen la sortie de la pierre plus facile. Sur ce dilatoire qu'il apele son conducteur, il poussa une tenete dans la vessie, et retira aussitôt ce conducteur, et après avoir cherché et chargé la pierre, il retira sa sonde de l'urethre, et ensuite sa tenete avec la pierre de la vessie, par la playe: ce qu'il fit avec beaucoup de facilité, quoy que la pierre fût à peu près de la grosseur d'un œuf de poule.

“ Cette operation étant faite, je dissequay, en presence de Messieurs les medecins de chirurgiens de l'Hôtel-Dieu, les parties qui avoient été coupées. Par la dissection que j'en fis, et en les comparant avec les mêmes parties oposées que je dissequai aussi, nous

form; he took a common knife, remarkable only for its length, with which he made an incision by the side of the left ischium, and, cutting with it obliquely upwards, he divided all the parts betwixt the tuber

remarquâmes que Frère Jaques avoit coupé d'abord des graisses, environ un pouce et demi d'épaisseur, qu'il avoit ensuite conduit son scalpel entre le muscle érecteur et l'accelerateur gauche, sans les blesser; et qu'il avoit enfin coupé le col de la vessie dans toute sa longueur par le côté, et environ demi pouce du corps même de la vessie.

"Deux jours aprés cette experience j'allay chez Monseigneur le premier president luy rendre conte de ce que nous avions observé, et luy dire mon sentiment sur l'operation de Frère Jaques. Voicy le raport que j'eus l'honneur de luy en faire.

"1. Monseigneur, la manière d'operer de Frère Jaques me paroît beaucoup plus avantageuse pour l'extraction de la pierre, que celle qui se pratique ordinairement; parce que l'incision étant faite dans le col et le corps de la vessie, et la pierre tirée par la partie la plus large de l'angle que forment les os pubis, elle peut sortir avec facilité et sans aucun éfort: mais dans l'opération ordinaire, comme on ne fait d'incision qu'à l'urethre; que l'on tire la pierre par le col de la vessie qu'on n'a point coupé, et par la partie la plus étroite de l'angle que décrivent les os pubis par leur union; il est visible que par ces endroits qui sont fort étroits, on ne peur pas tirer la pierre qu'avec de grands éforts et une extrême difficulté, pour peu qu'elle soit grosse: d'où il est aisé de tirer cette consequence, que l'opération que fait Frère Jaques, pour tirer la pierre hors la vessie, ne doit pas être suivie d'accidens aussi fâcheux, que ceux qui suivent de l'opération ordinaire. Premièrement parce que par sa manière particulière d'operer, il ne coupe aucun des muscles de la verge: mais dans la commune on separe entierement les deux muscles accelerateurs l'un de l'autre par l'incision que l'on fait dans l'endroit de leur union, qui est le lieu de leur origine. De-là vient que ces muscles perdent souvent leur action.

"2. En faisant son opération, il coupe à la verité le corps des prostates, le col entier de la vessie par le côté, et un peu de son corps; mais ces parties n'étant arrosées que par de petits vaisseaux, l'hœmorragie n'est pas tant à craindre que dans l'opération ordinaire, où l'on coupe toujours la partie spongieuse la plus épaisse du canal de l'urethre, dans laquelle les deux arteres de la verge déchargent une grande quantité de sang.

"3. Son opération ne peut pas être suivie ni de l'échymose, ni de la fluxion, ni de la supuration qui se font fort souvent dans les membranes des bourses, à l'occasion de l'opération ordinaire; parce que l'endroit par où il entre dans la vessie, n'a pas de communication avec le scrotum, comme en a le perinée que coupent d'abord tous les autres lithotomistes.

ischii and the staff, which he allowed to remain in the bladder: he cut so freely upon the staff, as to admit the finger into the bladder; along the finger he introduced an instrument which he called his conductor, as if to dilate the wound, and along the conductor he passed the forceps. Having introduced the forceps, he withdrew the conductor; upon finding the stone, he withdrew the staff also: and having seized the stone, he drew it out with all imaginable ease, though almost the size of an egg.

"Upon dissecting the body," says Mery, "in presence of the physicians and surgeons of the Hôtel Dieu, I found, by comparing the incision with the opposite side of the perinæum, that he had cut through skin and fat about an inch and a half in thickness; that he had then carried his knife betwixt the accelerator and erector muscles, without wounding either; and that he had cut laterally through the

"4. Faisant une longue incision au col et au corps de la vessie, par la quelle il tire la pierre sans peine, il évite la contusion et le déchirement de ces parties, qui arrivent presque toujours au col de la vessie, aux prostates qui lui sont jointes et à l'urethre dans l'opération commune, pour peu que la pierre soit grosse et sa surface raboteuse. De la vient que les parties qu'il divise, n'étant que coupées, peuvent plus facilement se rëünir après son opération : d'où il suit qu'il doit y ariver moins de fistules qu'aprés l'opération ordinaire ; parce que dans celle-cy les parties souffrant presque toujours une forte contusion, il leur arrive une perte considerable de leur substance, par la supuration qui s'en fait ; ce qui empêche leur réunion, et produit la fistule. Mais il me paroît, Monseigneur, que Frère Jaques pouroit entrer, comme il fait, dans la vessie, en faisant son incision deux pouces plus haut que l'endroit qu'il coupe d'abord : ce qui rendroit la playe beaucoup moins profonde, et par consequent sa guérison plus facile ; suposé qu'une playe du col et du corps de la vessie ne soit pas mortelle le plus ordinairement, comme on l'a cru jusqu'icy, et que le sphincter de la vessie puisse se réunir aussi exactement qu'il étoit. Pour cela il en faut venir à l'experience."

whole length of the neck, and half an inch of the body of the bladder.

" Two days after this experiment," says Mery, " I waited on my lord president to declare the facts, and present my report and judgment on the operation; and this was what I said: It appears to me, my lord, that the operation of Frère Jaques is more favourable with respect to the extraction of the stone than that in common use; for a wound made thus in the neck of the bladder will permit the stone to pass easily, and, being extracted through the widest part of the opening of the pelvis, it will be brought along without violence: whereas, in the common operation, there being no incision but in the urethra, and the stone being forced through the neck of the bladder still entire, and through the narrowest part of the arch of the pelvis, the operation cannot be accomplished without extreme difficulty, and (wherever the stone is large) with great violence."

" The conclusion then, my lord, is plain: That the operation of Frère Jaques must be less liable to accidents than that in common use. He cuts none of the muscles of the penis, while the incision of the apparatus major divides the accelerator muscles instead of the rapha. His incision divides only the prostate and cervix vesicæ, which are supplied with none but smaller arteries, while the incision of the apparatus major slits up the bulb, the most cellular part of the urethra, and that into which the chief arteries of the penis pour their blood. His incision causes neither echymosis nor suppuration in the scrotum. The incision of the apparatus major is in the perinæum, touching the scrotum, while Frère

Jaques makes his way into the bladder by an incision far distant from the scrotum."

"By this long and free incision in the neck of the bladder, sufficient for the easy extraction of the stone, he saves the patient from that contusion and laceration of the neck of the bladder, of the prostate, and of the urethra, which are inseparable from the old method. After his incision, the parts must unite more easily, and fistulas must be less frequent than in the common operation, where the violence is such that there is, from suppuration, an actual loss of substance, which endangers fistulas and prevents the cure: whether such wounds of the neck and body of the bladder are not really fatal, as has been hitherto believed, whether the sphincter will reunite and resume its office, are questions which experience must decide."

This report is such as we can read with unabated pleasure; these expressions imply a zealous rational approbation, and the line of distinction is fairly, I would say irrevocably, drawn, betwixt the old operation and the new! The whole manner of his harangue, before the president, does equal honour to his head and heart, to this unknown friendless man and to himself. Mery was as yet untainted with politics: he had, indeed, some lingering scruples about wounds of membranous parts; but these he seems ready to abandon; for though he was a pupil of the old school, and hardly believed, he yet seemed willing to believe, that wounds of membranous parts are not mortal.

The honour and honesty of Mery were soon and easily corrupted: If the principles of those two operations were so essentially opposite to each other, and this new method so worthy of approbation, no errors of the operator, no want of skill on the part of a man confessedly ignorant of anatomy and the common principles of our profession, no occasional deviation of his knife, should have persuaded Mery to reverse a decision so deliberately pronounced! for his approbation was founded, not upon the dexterity or success of the operator, but upon the mere principles of the operation. But Mery, hurried away by the torrent of professional jealousy, was found, even before one little week had passed away, acting as the instrument of a malicious party, condemning impudently the operation he had just approved, publishing malignant criticisms on the occasional errors of the operator, and, in but a little while, we find him deputed to make a public harangue in the name of the professed enemies of Frère Jaques.

Those lithotomists of Paris, and the physicians and surgeons of the Hôtel Dieu, who had been upon the inquest, did not continue long indifferent to the impressions made by this first report; new and severer trials of Frère Jaques' abilities as an operator were immediately required; and dissections, proving the dangers of this operation, and harangues, proving the incapacity of the operator, followed the first generous avowals of his excellent talents.

" I received," says Mery, " on the 14th of the same month of December, a second order from Monsieur the first president, to attend, at the Hôtel Dieu, some farther trials of the operation of Frère Jaques. At this time he performed two experiments: he cut upon the body of a woman, and upon the body of a boy, from twelve to fourteen years of age. The boy he cut upon the staff, dividing the accelerator, which he had spared in his first operations; and he so lacerated the beginning of the urethra, the neck of the bladder, and part of its body behind the pubis, that the bladder was almost entirely severed from the urethra."—"But these injuries," says Mery, "might perhaps be more justly ascribed to the delicacy of the parts, than to the pushing in of his finger, though it is none of the slenderest."

"On the body of the female subject he cut, not upon the left side, as usual, but upon the right side close by the tuber ischii, on the apex of the hip (moignon de la fesse), having previously introduced into the bladder the same staff he was wont to use in men. By his incision (the lower end of which was opposite the anus, the middle opposite the perinæum, and the upper end opposite the orifice of the vagina) he cut the vagina entirely across, and opened the bladder from the place where the ureters enter, up to the beginning of the urethra."

These were sad mistakes: but consistency was not to be expected from Frère Jaques, neither were the incorrect and careless incisions of a rude operator to be imputed to the method he used. 'How could one like Frère Jaques, who knew nothing of the anatomy of the parts, be correct and uniform in his incisions? He had, in cutting the boy, almost separated the bladder from the urethra; in the body of the woman, he had wounded the vagina; he had performed lithotomy on the female, with the same staff, and had made the same incision in the perinæum, as in man, cutting upwards from the point of the hip: all this is true; and if, on those grounds, Mery chose to retract his first opinion; if he chose to avail himself of the argumentum ad hominem, and say, I have proved him a bad operator, and his operation, of course, cannot be good; if he chose to impute these mistakes of the operator to the imperfection of his method, we cannot deny his privilege: but what becomes of his first eulogium of all that is essential to this method? of his decided preference of incision to laceration, in so far, at least, as belonged to the extraction of the stone? how has he forgotten so suddenly the desire he expressed, but a few days before, of "learning, by experience, whether wounds of the membranous part of the bladder were really mortal."

Neglected in Paris, and deprived of the support of the president Harley, by these machinations of professional men, Frère Jaques repaired to Fontainebleau, where the court then was, and where the approbation and friendship of the court physicians, and the notice of the king himself, soon consoled him for these disappointments, and enabled him, in a few months, to return to Paris in triumph. "He introduced himself, by letters, to Duschene, first physician to the princes of the blood, who was delighted with his manner of operating, with his well attested cures, and especially with his zeal, and the humane motive which had induced him to visit the city. By Duschene he was carried to Bourdelot, physician to the Duchess of Burgundy, to Fagon, first physician, and to Felix, body surgeon to Lewis XIV." While they were expressing the most earnest desire to see him perform his operation on a living body, "there fortunately presented himself a shoemaker's boy, of Versailles, who lived, at that time, at Fontainebleau, cruelly afflicted with the stone. This boy, Duschene, by order of the court, lodged in the house of a nurse, and ordered him to be liberally supplied with every necessary: On this poor boy Frère Jaques performed his operation in presence of Fagon, Duschene, and Felix, and with such address, that they retired highly delighted with the operator, and Felix, in particular, was so charmed, that he carried him home to his own house, and kept him there while the court remained at Fontainebleau."

"This operation was rumoured abroad: it must be acknowledged," says Dionis, "that this was a coup d'essai, most fortunate for Frère Jaques; the operation was rapidly performed; the boy passed his urine naturally soon after the operation; no ill system retarded the cure; and, in three weeks after the operation, he was seen walking in the streets of the village*." Besides this boy, he cut six others at Fontainebleau, four in the hospital, and two in private: his address and courage were loudly proclaimed by the physicians and surgeons of the royal family: the prince took a particular interest in the fate of the boy, the bulletin of whose health was daily presented to the court, by Duschenes; and when the lad was seen walking abroad again, the king was heard to say, "This is a man that must not be neglected." Orders were issued accordingly, that Frère Jaques should be lodged and maintained at his majesty's expense.

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* The biographers of Frère Jaques have all copied this narrative from Dionis; but the most unaccountable tradition is that propagated by the elegant translator of Heister, who tells us, that "this boy was seen, in three weeks, walking about in the areas." If this be true, and it be also true that the boy, as was reported by many, laboured under a perpetual fistula, and incontinence of urine, he chose his walks well, and would never be out of his way. Of all the good books that have ever been mangled by ill translating, Heister's has suffered most; for his translator, though ignorant of every language, is yet so fond of translation that he translates even the names of places, and instead of Bois le Duc, he makes Verdun "convoy Friar James to Duke's Park;" without knowing one technical term, or the name of one instrument in surgery, he has impudently translated a whole system; and, what is more unaccountable, without improving his knowledge, either of the profession or of the language of his original; for the end of his translation is as ignorant as the beginning of it.

The king now returned from Fontainebleau to Versailles, after an absence of four months; and Frère Jaques approached the capital a second time, strong both in reputation and in friends, hated by none but the surgeons, supported by the authority of the court and the enthusiasm of the people: "all the world knew of what he had done at Fontainebleau, and those afflicted with the stone were sought after, and placed under the care of Frère Jaques as the greatest charity and favour that could be done them."

His progress was rapid and enterprising; his success may be estimated by the fury with which he was opposed; ten or twelve operations performed, in the city of Paris, with a degree of eclat, gave him new claims on his protector Harley, who required once more a decisive report from the surgeons and physicians of the Hôtel Dieu. This produced an extraordinary and agitating scene in the palace of the archbishop of Paris, where the great question was finally and solemnly decided, whether Frère Jaques should be received into the hospital to cut for the stone. To contemporary writers we must naturally appeal, not merely for facts and documents, but for their sense of the machinations and professional politics of the day; and we find every reason to believe that a plot was engendered among these restless men. The debate, in the archbishop's palace, was plainly a contest betwixt the friends and the enemies of Frère Jaques. "Among the mob of lithotomists in Paris," says M. Garengeot, "the utmost solicitude and consternation prevailed, when they saw the operation of the apparatus major about to fall into utter neglect; themselves about to become pupils to new masters, and, as pupils, not likely to be esteemed nor employed, in an operation so new to them; they strove to weaken the favourable impressions made by the first report of Mery, and Mery himself was carried with them down the stream*." Garengeot declares, "that it was the design and policy of Mery to extinguish, though of the utmost importance to society, the discovery of a harmless unprotected man†." Shallow policy and short-sighted! for the talents and good fortune which require such measures are not easily subdued! Seldom has such experiment been tried without raising the object of jealousy to an unmerited degree of honour.

On the 7th April, in the year 1698, the magistrates of the city, the physicians, the surgeons, and the managers of the Hotel Dieu, were assembled, in the archbishop's palace, to try this cause; and Mery acknowledges, that it was at the request of the lithotomists and surgeons that he opened the debate. He affected to speak with his wonted impartiality; but he was now the avowed head of a party: he reversed his first favourable report, and retracted even his doubt, about the mortal nature of wounds in the membranous part of the bladder: he declared that he had a strong persuasion (mais il est fort à craindre) that the sphincter vesicæ, once cut, will never reunite; that incontinence of urine must ensue; that Frère Jaques's operation, in which the knife passes from the hip to the bladder, by the side of the vagina, in woman, by the rectum in men, and close to the hypogastric arteries in both sexes, endangers all these important parts: "And the injuries of these parts," says Mery, "being so much more important than any that happen in the apparatus major, I leave you, gentlemen, to decide, whether this operation be not more dangerous than that in common use." This harangue, which began with some insipid compliments, ended in the impeachment of an operation, the principles of which he had solemnly and deliberately approved; it was a harangue so violent as to lay open the designs of the party, and expose Mery to be accused of the most disingenuous conduct. It is spoken of by Morand, in terms of indignation and contempt, as a sad specimen of the restless politics of that intriguing city. "We too often," says Morand, "perceive, among men of science, a spirit of persecution and rancour, which deadens all emulation; and from such a spirit I have myself suffered much."

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* "Mais une foule de lithotomistes, déjà consternés de voir la taille au grand appareil prête à tomber dans l'oubli, se dirent qu'ils alloient devenir des écoliers, qui pourroient bien n'être pas les plus habiles dans cette nouvelle manière, ni par consequent les plus recherchés.

"Ainsi des lors on essaia d'affoiblir le suffrage de M. Mery en faveur de Frère Jaques. M. Mery lui même se laissa emporter au torrent."

† "Mais le parti étoit pris; et il falloit étouffer une découverte nouvelle, quoique de la dernière importance, parce qu'elle étoit inventée par un homme sans nom."

The detail of those cases I have transcribed on the margin*; and in Mery's comment upon them, we

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* Report of the patients cut by Frère Jaques, in Paris and Versailles.—"After his arrival in Paris in the spring 1698, Frère Jaques procured many patients in private. First, he went down to Versailles, and there cut four people in La Charité, and two in private, among whom was a soldier of the Irish brigade, who having received a musket-shot five years before in the bladder, the ball formed the nuclæus of the stone. Among these patients was a little girl of seven years of age, who died on the third day, and her body was dissected by Felix, the king's surgeon, and by Dionis, whom he had invited to go along with him. 'We found,' says Dionis, 'that the bladder was wounded in its body near the neck, and in the vagina we found a wound the size of a nail, which the knife had made in passing by the side of the vagina to reach the bladder; upon observing this, Frère Jaques said that wounds of the vagina were of very little consequence! that he often wounded the vagina.'"

"La cour partant pour Versailles, Frère Jaques prit le chemin de Paris, où sa reputation l'avoit devancé. Il y trouva tout le monde informé de ce qu'il avoit fait à Fontainbleau, et chacun s'empressa de lui procurer des sujets, croyant leur faire plaisir que de les mettre entre les mains du Frere. M. Felix m'envoya chercher pour aller avec lui en faire l'ouverture; nous trouvames la vessie ouverte dans son corps proche son col; c'est-à-dire, en l'endroit où il a coutume de l'ouvrir; nous vimes au vagin une plaie de la longueur de l'ongle, elle avoit été faite par le tranchant du bistouri en le poussant le long du vagin pour aller à la vessie. Frère Jaques dit à cela que les plaies du vagin n'étoient d'aucune consequence, et qu'il lui arrivoit souvent de le percer."

"In Paris, about the beginning of April, before the conclave held in the archbishop's palace, he had operated, in private, upon eight patients: first, upon Madame La Lorraine, in whom he cut the vagina through and through, as I could perceive by the profusion of blood which issued through the orifice of the vagina." (Mery.) "And upon trying his operation myself, the same day, by order of the lord president, on the dead bodies of a woman and a girl, I found that I had pierced the vagina in both. Next I saw Frère Jaques cut a boy, of sixteen years of age, from whom he extracted five pretty large stones; he suffered at the time considerable hæmorrhage, and even on the third day, the blood continued to issue by the wound, the penis, and the anus; which shows clearly that the intestine was wounded. This boy died in September, fistulous, but his body was not opened. Next I saw him cut two men and a boy; one died of hæmorrhagy, of the other I knew nothing. Of the boy I am assured, by Mr. Thomas, a surgeon, that he has a may see plainly the proofs of that malice prepense of which he was accused; his pettifogging zeal had enabled him to collect together only a few idle and malicious tales, from this physician, and that surgeon! nameless and treacherous men, who had been permitted by Frère Jaques to be present at his private operations. But with all his industry, he was able to make out no worse accusation than this, that of eight patients cut by Frère Jaques, two were dead, (de huit qu'il a taillés deux sont morts trois jours après), and this, with his conjectures concerning the injury done to the vagina of Madame La Lorraine, and the wounded intestine of the boy, (vide report in first foot note), was all he could allege against Frère Jaques! but as the lady was reported alive, and the boy was reckoned against Frère Jaques, among the dead, Mery should have said no more about the rectum of the one, nor the vagina of the other.

Impartial writers tell a very different tale of his success. "Messrs. Dupont and Sauré (my colleagues)," says Garengeot, "agree with many other surgeons, of unquestionable veracity, in saying that they have seen Frère Jaques operate, not only on the sixty patients cut in the Hotel Dieu, (after this debate), but on a great many privately in the city, (viz. those mentioned in this report of Mery); and they assure me, that the steady and deliberate manner of

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tumor in the groin, and passes his urine insensibly, although his wound is actually cured."—"I have heard of his cutting three more in Paris; of one of these, a little boy, a physician who was present assured me, that, having cut the boy by the gripe, he had introduced alternately his scoop and forceps, till the boy was quite exhausted; that two days after he died of convulsions, and, upon opening the body, the bladder was found lacerated as if with an iron comb."

his incision, and the ease with which he passes his forceps, and immediately extracts the stone, without any violence, charmed all who beheld him."—" It is no wonder," say these gentlemen, " that we have, among so many operations, seen several which were followed by very dismal consequences; but we declare that we have seen by far the greater number of these patients recover with inconceivable rapidity, and without the slightest mischance or interruption *." While the impartial, among his countrymen, defended him from those imputations, strangers were not insensible of the malice of his rivals, and came, at last, to receive the many ill things reported of him with great caution. " I am sensible," says Dr. Leister, in his letter from Paris, " that he has got abundance of enemies, which makes me very often question what I may hear said of him."

At the conclusion of Mery's oration, the physicians, the patrons and defenders of Frère Jaques, came forward; they acknowledged the facts detailed by Mery; they also acknowledge that this method of incision in the neck of the bladder, which had been used in former times, had probably been abandoned from a sense of its dangers. But they reminded the assembly, that

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* " De plus, Messieurs Dupons et Sauré mes confrères, et plusieurs autres chirurgiens dignes de foi, m'ont assuré avoir vu tailler par Frère Jaques, non seulement une grande partie des soixante sujets qu'on vient de citer, mais encore un assez grand nombre de personnes dans Paris ; et m'ont certifié que la façon delibérée avec laquelle cet opérateur travailloit, et la facilité avec laquelle il poussoit ses tenettes dans la vessie, et en retiroit promptement les pierres, sans faire aucun effort, charmoit tous les assistans. Il est vrai, m'ont ils dit aussi, qu'ils ont été temoins de plusieurs taillés qui ont été suivies d'accidens très funestes, mais aussi qu'ils en ont vû guerir une bonne partie avec une promptitude inconcevable, et sans avoir eu le moindre accident."

his successes in the provinces were well attested, while his miscarriages in the city were not such as justly to exclude him from farther trials; they declared it as their opinion, that farther experiments should be allowed; and, in the end, so different was the sense of this assembly concerning his success, from that which Mery wished to impress upon them, that it was agreed before the meeting rose, that Frère Jaques should, during the ensuing season, be permitted to perform the operations of La Charité and the Hotel Dieu.

Spring was come, the season for cutting for the stone in France; and Frère Jaques now exhibited, on the public stage, with a degree of steadiness, courage, and skill, which delighted all impartial spectators: but, for this temporary triumph of our operator, the surgeons and lithotomists of Paris took a deep and lasting revenge. In the month of April he began his operations, and in a few weeks had cut sixty people of various ages for the stone. "He laid his patient upon the operation table, and, placing a pillow under his head, gave him to the assistants to hold, with the thighs elevated, and the heels bent towards the buttocks. He never tied his patients, as they did, in performing the more lingering operation of the apparatus major." "He made use," says Bussire, "of a steel staff much bigger and shorter than that in common use; it was shorter from the handle to the heel, where it bends more than ours, and he had but two, one for women and one for men." He introduced this staff, (big, round, and having no groove,) into the bladder, and, holding it with the left hand, he pressed it so against the perinæum, as to make that part of the bladder project, which he meant to strike with the knife. Then taking in his right hand a long knife, dagger-shaped, he plunged it into the left hip, at the distance of two inches from the perinæum, and pushing it directly onwards, opened the body of the bladder as near as possible to its neck, never once withdrawing the bistoury, till he had made an opening proportioned to the size of the stone*. He then introduced his finger to feel for the stone, and running in a conductor along the finger, he introduced the forceps upon it; and, having seized the stone, pulled it coarsely out, indifferent to the effects of that violence with which it was extracted."—"Having extracted," says Dionis, "whatever stones remained within the bladder, he cares nothing for the patient, applies neither defensive nor astringent, contents himself with a little wine and oil for a dressing; and when he has been remonstrated with concerning the necessary and decent care of his patient, this has been his answer: 'I have extracted the stone, God will cure him.'"

Such was the nature of his operation, and as for the manner in which he performed it, it is spoken of with the highest applause. What must have been the feelings of admiration and thankfulness, when, in place of tying the patient, as for the apparatus major, in a manner more cruel by far than that now in use, the patient was simply held down upon the table?

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* "Puis prénant de sa main droite un bistouri long, fait en forme de poignard, il le plonge proche la pointe de la fesse gauche deux doigts loin du perinée, et le poussant droit vers la région de la vessie, il l'ouvre dans son corps le plus près de son col qu'il peut; il ne retire point le bistouri qu'il ne l'ait ouverte autant que le demande la grosseur de la pierre."

when, in place of the difficulties and delays of the apparatus major, the labouring with the dilators, the cries of the patient, and the doubts which the spectators endured, often for an hour, whether the stone could at last be extracted! this ignorant but dauntless operator struck his dagger-like knife into the hip, far from the usual place of incision! moved it upwards and downwards to enlarge the wound, passed first his finger into the bladder, and then the forceps, and in a few moments extracted the stone, though as big as an egg? The doors of the hospital where he operated were besieged at an early hour, and such was the press of spectators, that sentries were required to keep back the mob; no physician nor surgeon of the city was absent from his operations, and strangers resorted to Paris from all quarters, to see him operate. They were awestruck when they beheld him drive his knife deep into the hip, and keep it there, searching with the point of it for the stone, and enlarging the wound according to its size.—"There was no one who did not tremble at the dreadful manner of his incision, and surgeons, inured to operations, were altogether confounded and affected with horror, when they saw him keep his knife so long within the parts*."

I have compared and translated Dionis and other authors faithfully, and cannot be deceived, in regard to the form of his poniard-shaped knife, or the manner in which he struck it into the hip. Leister, who then lived in Paris, and took a particular interest in this operation, says of this operator, " He cut both by the small and the great apparatus, and in both he boldly thrusts a broad lancet or stilletto into the middle of the muscles of the thigh near the anus, and plunges it till he meets the staff or the stone."—" I saw him," says Leister, " perform the operation upon nine persons in three quarters of an hour, very dexterously: he seemed to venture at all; and put me in some disorder, and a stouter Englishman than myself, with the cruelty of his operation. However, I visited them all in their beds, and found them more amazed than in pain*."

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* "Il n'y avoit personne qui ne tremblat en le regardant opérer; et les chirurgiens mêmes, quoiqu' aguéris sur ces sortes d'opérations, étoient effrayez de lui voir tenir son couteau si long tems dans la plaie."

Even his enemies durst not deny that he was endowed at once with uncommon courage and presence of mind, joined to the most amiable dispositions. " Reports," says Mery, " which have come to us from various quarters, incline us to doubt the story he relates of his own life; yet all the world allows him to be a man of unsubduable boldness; he never, in time of operation, was seen to falter, or seem dismayed: he has a firm and steady hand; never perhaps has there been seen a more daring operator: he is withal pious and charitable, and it were greatly to be wished that such a man were better instructed in the anatomy of the parts."

" Frère Jaques cut also in the same way in the other hospital, La Charité, much about the same time, eleven at twice. Mr. Marechal, the best of the surgeons for this operation in Paris, harangued against him before the governors, who coldly replied that they would be determined by the event, which was best."

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* Leister's Journey to Paris, p. 237.

The event was most distressing to his friends and favourers; his patients began to die in the hospital of La Charité, and Mery was employed once more in the welcome task of dissecting the patients and ruining the reputation of the lithotomist, till he at last drove him out of the capital to wander over the provinces of France. Of the patients cut by Frère Jaques in La Charité, nineteen in number, eleven only survived; nearly half his patients (seven of them) were in one day carried to the Salle des Morts*. Yet the fate of these patients, far from injuring the reputation of Frère Jaques, raised the popular enthusiasm to its utmost fervour! it was universally believed, that the religious who officiated in the hospital mangled, in the course of their dressings, the wounds which Frère Jaques had made correctly, and actually poisoned his patients, so that they died.

There are inauspicious moments in the life of every individual, which, if he perform in public a part important to society, become remarkable. The fortune of Frère Jaques was now at its crisis; stung with chagrin, he most unwisely accused the monks, a vindictive set of men, and of powerful influence, or if he did not directly accuse them, he was accessary to the report propagated by his friends, for a singular scene took place in the hospital of La Charité, which shows his imprudence. The reverend father prior of the hospital, when the patients of Frère Jaques began to die so many in a day, sent for Mery and Marechal to dissect the bodies; he had the discretion and prudence to send at the same time for Frère

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* Il mourut à La Charité jusqu'à sept en un même jour.

Jaques, and while the anatomists were employed in the dissection, the prior, turning to the friar, told him, " that it was altogether unbecoming a man of integrity or principle, to accuse, as certainly he had done in the city, the priests and surgeons of La Charité of destroying the patients, by thrusting instruments into the bladder after this operation."

Is it to be believed, that men professing religion and charity, and voluntarily devoted to the care of the sick, could be guilty of so unnatural a crime! of taking away the lives of fellow creatures, merely to disgrace his operation? Frère Jaques was maddened with jealousy, and willing to allege any thing but the natural causes as the occasion of his patients dying; and it was a sure proof of declining reputation that he was reduced to an artifice so low as this. His patients began also to die in the Hotel Dieu, where there were no surgeons unfavourable to his cause, no priests to poison or destroy, no time indeed to meditate or commit such cruelties, for very generally his patients died before the first dressing, on the third or fourth day. The report of Mery is, on this occasion, but too true, that of the sixty-two patients cut in both hospitals, twenty-five died. The proportion of deaths was small indeed, compared with the mortality of the Hotel Dieu in former times; but it was so unexpected as to astonish the vulgar, who looked for miracles, who believed him a man peculiarly endowed by Heaven with the talent of performing operations: perhaps they believed that none should die. Collateral authorities agree nearly in the numbers that died: Mr. Probie, an English gentleman, then in Paris, writes thus to his friend: " Frère Jaques's reputation mightily slackens, for of forty-five cut in the Hotel Dieu, but sixteen survive; and of nineteen cut in La Charite, only eleven survive: but I am sensible that he has got abundance of enemies, which makes me very often question what I hear; the surgeons have a great mind to cry down this man, while they practise his method."

Frère Jaques, wearied and dispirited by unremitting persecution, and affected by the death of so many of his patients, left Paris to travel over the provinces: by letters from Mr. Noel, we find him, in July in this year (1698) at Orleans; at Aix-la-Chapelle in August; and soon after we find him announced in the Dutch newspapers as lithotomist to his most christian majesty, a title which he ventured to assume on the strength of his certificates from the physicians of the court: in the year 1699, we find him introduced in Holland, to M. De Bonrepos, then ambassador from France.

Whatever the busy talents of Mery had discovered or invented concerning the dangers of this operation made but a slight impression on the public mind. Marechal in Paris, Rau in Holland, and Chesselden in England, practised this operation, opposite as it was in its principles to that by the apparatus major, which they had hitherto performed. In Holland and Germany Frère Jaques was received with the same enthusiasm as at first in Paris, and every where his dexterity and presence of mind were applauded. When he set out from Zutphen for Amsterdam, a nobleman whom he had cured apprised Verdun of his arrival, and requested that he might be respectfully received. "And accordingly, Guerell, chief physician to the hospital at Amsterdam, with several other persons of merit and distinction, had a meeting in the house of the brother of this nobleman, after the arrival of Frère Jaques: they conversed with him, and viewed his instruments. His catheter, we are told, was then without a groove, and his first operation in that city was performed upon a lad who was a waiter at a capital inn: at this operation were assembled, by order of the senate, the chief physicians of the hospital and city, and along with them Berengarius; and Frère Jaques performed his operation before them with so much sleight and dexterity, and in so short a time, that it raised an admiration in all that were present, and made them praise and extol our operator even before the senate *."

The excellency of Frère Jaques's operation had made a deep impression on the mind of Mr. Fagon, who never ceased to think of him, and, being himself afflicted with the stone, resolved sooner or later to put himself into his hands; for though Marechal and all the best surgeons in France and Holland performed this new operation, and, by their acquaintance with anatomy, performed it with sufficient skill; yet Fagon could not forget the bold and decisive manner in which it was performed by Frère Jaques himself. He was the first who received Frère Jaques kindly at Versailles: he had dismissed him, even after his misfortunes in Paris, with flattering testimonies of his approbation: he marked his progress through Germany and Holland: and, in the year 1700, he recalled him to Versailles, invited him to lodge in

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* Heister.

his own house, and persuaded him to go through a complete course of studies and dissection.

This forms a new and interesting epoch in the life of this extraordinary man, who, after being long an operator, submitted to the discipline of the schools, and, by studying under the greatest masters, added to his natural talents and address a knowledge of the parts.

Many a fool, affecting indifference to the natural fear of death, has blazoned his folly by building himself a tomb or placing his coffin in his bed-chamber: but Fagon, from manly and sensible motives, did what denotes to me greater firmness of purpose! He accompanied Frère Jaques through a suite of dissections, with a continual reference to the operation which he was himself to suffer; and witnessed, in living subjects, in the hospital of Versailles, experiments in that operation, the casualties of which might deprive himself of life. Frère Jaques was made first to operate on dead bodies, the parts being dissected by Du Verney, and then the peculiar dangers of his operation, so plainly superior to every other, were impartially discussed. Every thing dangerous was next corrected, and the necessary improvements explained to Frère Jaques, who received at once the lessons of Du Verney, the most celebrated anatomist, of Felix, the king's body surgeon, and of Fagon, his future patient and his friend. It was finally resolved that he should operate, in future, with a grooved staff; and with this corrected instrument he renewed his experiments, which were soon declared by Du Verney to be complete. With this improved staff and corrected operation, he cut thirty-eight patients in Versailles, as is proved by the certificates of Bourdelot, Boudin, and Gervais, surgeons in ordinary, without losing one. This was the secret of all his after-successes; for, when Frère Jaques passed again into Holland and Germany, he cut with astonishing success; no ill reports followed him as in his first career. "Ferhius, a Swiss physician," (who published a thesis, anno 1716), says, "that of sixteen lately cut by Frère Jaques, in Strasburgh, one only died, and that an old man, whose death was predicted from his age and weakness." Frère Jaques, while operating in that city, whispered Salzmanus in the ear, "that he had left off his rude way of operating, and now used a grooved staff." Weisbachius testifies that he had seen Frère Jaques cut twenty for the stone, in Strasburgh, of which hardly one miscarried, but were all cured presently without fistula or any other distress.

Never were any lessons of men of science more successful than these of Fagon and Du Verney, nor received with more modesty and thankfulness by any artist. He would teach well and diligently! who was to reap, so immediately, the fruit of his own labours. Frère Jaques, in a little memoir which he wrote in defence of his reputation, mentions his gratitude to Fagon in the following terms*: "Frère Jaques had observed that the dangers and injuries connected with this operation proceed chiefly from the wounding of the root of the penis, where its cavernous bodies join, and that to avoid these dangers the incision should be made in the neck of the bladder; and having of late introduced himself to Messrs. Fagon and Felix, the king's physician and surgeon, and performed many operations before them, upon both dead and living bodies, they were persuaded that the operation was in itself good, superior to the old operation, and requiring chiefly to be improved in respect of the instruments; and they thought that a good grooved catheter should be used to ensure the place of the wound. Frère Jaques has reformed all this, has continued to practise this improved operation on the living as well as on the dead body, for four years, and has not neglected to observe other points in which his operation might be improved both in respect of the instruments and of the incision. Having been often examined by Messrs. Fagon and Felix, and the other surgeons of the court; having performed many experiments in their presence, both on the dead body and on the living, these gentlemen, regarding his operation as very valuable to the public, have been pleased to grant their approbation; which has been seconded zealously by the mayors, sheriffs, and governors, of the various cities and provinces of France." The surgeons of the court had, indeed, behaved in the most liberal manner: they procured him passports from the court: they gave him the most unqualified certificates of his superior skill and courage: they bore witness to his charitable and disinterested conduct, and to the perfect success of every operation performed in their presence: they ascribed his success to the improvements in his operation, to his skill lately acquired in anatomy, and to his using a grooved staff, from the groove of which he never moved his knife till the incision in the neck of the bladder was complete. Nor was it from the court physicians only that he obtained those testimonials of his success; but from all the surgeons of Versailles: they gave it under their hands "that he had cut thirty-eight patients in the hospital with uniform good fortune." How different this from the invidious conduct of Mery, of whom Frère Jaques complains! but still with modesty and candour: "Of hundreds of healthy subjects cut after this improved method," says Frère Jaques, "none had died or remained fistulous, though Messrs. Mery and Saviard, master surgeons, have so affirmed in their writings, and have circulated those writings with such diligence, in all the provinces, as to impress the people with the most unfavourable opinion of him, which is indeed his chief reason for writing these few papers to undeceive the world."—"Why," says Frère Jaques, "should Mr. Mery declare this method good in itself, and requiring no other reform than that of cutting upon a grooved staff, without waiting the issue of that improvement which he had himself advised? without expecting impartially the result of future experiments? But indeed Mr. Mery takes a pleasure, not in assisting but in blaming the operator, and in accusing him of cutting the spermatic vessels in those he pretends to cure of the rupture, and he takes particular delight in likening him to one Raoult, whom he calls a mountebank and rogue. But in truth Frère Jaques, during thirty years that he has practised this operation, though he has operated on four thousand five hundred patients afflicted with the stone, has beguiled no one, nor ever operated but in presence of physicians and surgeons, and by their consent and advice*."

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* The Memoir was anonymous; Frère Jaques therefore writes in the third person.

There were, at this moment, two men of eminent rank who had resolved to submit to the operation of Frère Jaques; the one Mr. Fagon, first physician to Lewis XIV., the other the Mareschal de Lorges: both had taken measures to ensure the success of the operation, but, in the very moment that Frère Jaques was about to obtain the most distinguished honour, he suffered a sad reverse of fortune. Mr. Fagon had himself taught Frère Jaques, and with the assistance of Du Verney, the celebrated anatomist, and Felix, first surgeon to the king, had made him go through a series of dissections. His operation was reformed according to their desire; he had forsaken his big round staff, and cut upon a grooved one; he had operated on thirty patients in the Hotel Dieu, of Versailles, with uninterrupted success: he had already sounded Fagon, and felt the stone, yet Fagon, though thus far advanced in this generous design, was prevailed on, by the solicitation of his friends, to put himself into the hands of Marechal, who had learned to perform Frère Jaques's operation. Marechal accordingly performed the operation, and Fagon survived, and in a few weeks went abroad in his carriage.

The Mareschal de Lorges, of distinguished rank and great fortune, proceeded with equal precaution;

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* Vide Frère Jaques's Memoir in defence of himself, in composing which he probably had the assistance of Hanault and the advice of Fagon, Felix, and his other friends; for Hanault took a particular affection for Frère Jaques, consulted with him about the means of improving the operation, and promised to defend him from the insolences of Mery.

he assembled in his hotel twenty-two poor people afflicted with the stone, who were cut by Frère Jaques with perfect success; but while the poor patients survived, the Mareschal himself died in tortures the day following the operation. This was decisive of the fate of our operator; the Mareschal de Lorges lying dead in his superb hotel, while Fagon, cut by M. Marechal, was rolling in his chariot in the streets of Paris, was a triumph for the regular lithotomists and a mortal blow to the reputation of Frère Jaques, who now departed from Paris never to return.

Whatever judgment we may be inclined to form of this extraordinary man, we owe to his memory this simple respect, viz. of tracing his future course, till his arrival in his native village, where he resolved to end, in poverty and obscurity, a life spent in deeds of charity.

After leaving Paris he continued to travel for many years, over the provinces of France, Holland, Switzerland, Germany, and Italy; there was no country, except our own, in which he had not appeared. He was first invited by the senate of Geneva, to visit their republic: he cut five patients in the city and two in the adjacent villages, and received the public thanks of both the greater and lesser council. In the year 1704 he was earnestly solicited to visit the city of Amsterdam, where he arrived in the month of July, and by permission of the magistrates cut numbers in the hospitals of that city. He still preserved the character and outward signs of sanctity, charity, and simplicity of life: he was followed by the people with enthusiasm, and regarded even by those of better education, as one sent from heaven. But "Rau published journals of the success which the operation had upon those who were cut by the French lithotomist; which proceedings being laid open, demolished his reputation, so as to make him leave the place, in which office Rau was happily employed with very great applause, and retained till his death *." Thus were the politics of Paris received in Amsterdam, but when the place of city-lithotomist was bestowed on Rau, such tumults arose in the city that the magistrates were obliged to express, in a public manner, the gratitude of the people by conferring an honorary reward on Frère Jaques †. At Delft, Utrecht, Leyden, and the Hague, he had equal success; and on his visiting the latter city, the magistrates had his portrait engraved anew, and presented him with a set of golden sounds.

Rau, whose rare talents and incomparable meanness of disposition kept an almost equal pace, so that we know not whether most to admire or detest the man, published, like Mery, his daily scandals, and dissected Frère Jaques out of the capital of Holland! and yet he stole the very operation which he affected to condemn. But it was neither the treachery of Rau nor the unfavourable decision of the magistrates of Amsterdam that drove Frère Jaques out of the city; it was his own restless desire to travel. Having traversed Holland, he went to Angers, then to Brus-

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* Heister.

† They had his portrait engraved, the priest in his religious habit; in the distance was a hermitage; above it was written, "Ægri quia non omnes convalescunt, non idcirco nulla medicina est;" and below was written, "Frater Jacobus de Beaulieu, Anchoretta Burgundus Lithotomus, omnium peritissimus."

sels, and in that city received, as the last testimony of the gratitude of Amsterdam, a letter from the senate expressing their respect, and a medal bearing the arms of the city, a crown encircled with a wreath of oak, and the inscription, "*Ob cives servatos.*" He was even entreated by his private friends to return, and the modesty and humility of his reply deserves to be recorded—"Why should I return to your city when you have already a man so much above me, as Rau?"

In the year 1707 he appeared again in France; and, in his way to Lyons and the southern provinces, stopped at Versailles to visit Fagon, who received him with much kindness, and would have loaded him with presents, which he refused with great constancy, accepting only new certificates of his approbation and friendship, and passports from the court, for travelling in the southern provinces. He arrived at Lyons in the spring of 1709, from thence he was called again to Geneva; from Geneva he was called to Nancy, by the Duke of Lorrain, to cut one of his principal officers for the stone: and was prevailed on by the prince to remain in his states all that spring, and summer. During this season he cut eight patients successfully. He was next called to Liege, and there passed the winter of 1711. In the year 1712 he went to Strasbourg, and there it was that he whispered Salzmanus that he had reformed his operation and used a grooved staff; in Strasbourg he cut sixteen persons for the stone, losing only one diseased old man. Such was at this time the reputation of Frère Jaques, that while the invidious group of lithotomists in Paris believed him lost and neglected in some of the remote provinces, he was actually at the Court of Vienna, at the request of the Emperor Charles Joseph, whom he visited for several days along with his surgeons and physicians; but the Emperor's disease was not of the nature that was suspected when Frère Jaques was sent for, and he was accordingly dismissed with honourable presents. In April 1713 he departed for Venice, from thence he went to Padua, where he cut successfully; and thence he went to Rome to receive the benediction of His Holiness.

Wearied at length of travelling*, and desirous of visiting his own country before he died, he left Rome and never stopped till he arrived in his native village, where, of all his relations, he found only some of his nephews alive. Having distributed among those poor relations the little money that remained to him, he retired to Besançon, where he lived long, and died much advanced in years: he was buried in his native village, in the church of St. John, from the register of which Morand extracted the memorial of his interment. The medal presented by the city of Amsterdam was never found! the golden sounds he was known to have melted down before he died.

On reviewing what I have written of the life of this remarkable man, I feel loath to record such uncharitable persecutions, of one who spent his whole life in deeds of charity, who, while he had it in his power to become rich, died in poverty, perhaps in want. Let us judge now according to his deeds: a man who, while alive, "was extravagantly extolled by friends and traduced by adversaries," and was, as Heister says, "the subject of every one's thoughts and discourse," of whom this at last must be acknowledged, that through the various stages of a long and useful life, he proved himself a person of unfeigned simplicity and goodness.

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* How many years he continued to travel is not absolutely known, for while Morand closes his career in June, 1714, Heister assures us, on the authority of private letters from the surgeon Verdun, that he had seen him perform his operation at Strasbourg in the year 1715; and we are told by Le Maire, his countryman, that he died at Besançon, seventy years of age.

He chanced to appear in a country full of empyrics of the lowest class, and in an age when a jealous profession was striving to regain its privileges: he appeared as a mendicant friar professing sanctity, living on charity, and pretending a peculiar call from Heaven to cut for the stone: his certificates gathered up in haste, served only the needy purposes of quackery! for he was chiefly concerned about the speedy extraction of the stone, leaving the cure of his patient to Heaven. His advertisements were stuck up on the gates of cities, and in coursing from province to province he contrived to outrun the rumours of his ill success.

This man was, by a happy ignorance, pushed on to make these incisions in the body of the bladder, which physicians believed to be mortal; it was through the favour of the court, and the fanaticism of the people, that he was enabled to oppose a whole profession, and permitted to operate in the hospitals of Paris, Versailles, Strasbourg, and Amsterdam. But the enthusiasm created by his new and daring manner of operating soon expired; his patients died apace; his operation was critically examined by men skilful in anatomy, and it was not thought advisable that a man so ignorant, so adventurous, performing his incisions in so unguarded a manner, should be preferred to the regular lithotomists of France and Holland.

At first he was nothing but a bold and fearless operator, his courage being excited by enthusiasm, and nothing qualified by any knowledge of the parts or foresight of danger! He cut with all the audacious ignorance of a quack, sometimes high, sometimes low, sometimes in the body of the bladder, sometimes in the neck, sometimes upon the gripe, sometimes upon the staff! and in women he made his incisions in the perinæum exactly as in men: often he transfixed the bladder with his dagger-shaped knife, or, missing the bladder, struck his knife repeatedly into the hip, mangling the parts with transverse incisions.

Yet there was in his peculiar manner of operating that which reconciled men of science to his rudeness, and in his actual operations there was so much boldness, self-possession, and peculiar address, as made them think it a charity towards mankind to instruct him in the difficulties and dangers of his own operation! "Never," say contemporary authors, "has there been seen a more dexterous operator; the spectators tremble at the manner of his operation when he strikes his knife into the hip, and remain in breathless expectation, while he holds it there and searches with it for the stone, which he extracts to the amazement of all beholders." "He was a man," as the king had said, "not to be neglected, nor was his operation to be lost."

But Frère Jaques, after having received the instructions of Du Verney and Felix, and having lived in the house of Fagon; when he had reformed every step of his operation and accustomed himself to cut upon a grooved staff, performed an operation inferior to none practised since his time! He now was as skilful as he had at first been bold and fearless, and he had this peculiar happiness, that he was the very operator that France, or rather all Europe required, and his course of life was such as enabled him to do infinite services to his fellow creatures. The stone, from low living and uncleanliness, was, over all Europe, but most especially in France, a very frequent disease; his motives for devoting himself to this operation were very strong, and they are expressed in his memoir, in a simple and ingenuous manner. "The mayors, sheriffs, governors of provinces, have witnessed that dexterity and steadiness with which nature and long experience have endowed him; and they have also witnessed the zeal, piety, and charity with which he hath conducted himself, receiving presents from the rich only to give to the poor. But knowing, or fearing, that this would in the end be unto him an occasion of sin, he hath renounced all worldly goods by his vow, and given himself up to the service of those who are afflicted with the stone; the rich, when they send for him to distant provinces, bear the expenses of his journey, and the charity they themselves perform according to their hearts. Having observed the numbers afflicted with the stone in the various provinces of the kingdom, many of whom die from being unable either to send for one dexterous in such operations or to have themselves conveyed to any great city, such as Paris, to be cut there; having remarked also that the surgeons in the country parts have usually declined this operation, as difficult and full of danger; and it being for the public good that there should be able lithotomists in the provinces, Frère Jaques has forsaken his family, abandoned all other operations, and applied himself solely and with much diligence to this operation."

"It appears sufficiently," says Douglass, "from many particulars of his history, that Frère Jaques must have been a most profligate abandoned wretch." Never, I believe, was there a human creature less deserving these epithets *. We are, on the contrary, pleased to find resting on the mind, a respectful opinion of a man born in the lowest situation in life, but with good talents and worthy sentiments, and to whom our profession owes the discovery of that operation which we now perform. From his time the ineffectual cruelties of the apparatus major were abandoned, and his operation universally received; even those of the old faith who affected to perform the great operation, had their sly coup-de-maître, which they durst not avow; Rau, the celebrated Rau, learned his operation from Frère Jaques, and continued, during all his life, to conceal a discovery in which he had no right nor property, which he had

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* The man who wrote such language must have had an unfeeling heart, but he who proved a crime by the following jesuitical construction of the secret sentiments of one long dead must have had a depraved one. "He must," says Douglass, "have been a most profligate abandoned wretch, and that, under an outward air of simplicity and self-denial, he concealed some secret design or other, which perhaps the multitude of persons that died under his hands prevented his ever putting it in execution." Douglass, page 28. If a man is guilty or suspected of no crimes but those which he never puts in execution, he might reasonably enough expect to escape calumny.

learned from an itinerant operator whom he affected to despise and conspired to ruin.

ANATOMY OF THE OPERATION OF FRERE JAQUES.

Whatever in this operation is either creditable to the inventor or useful to posterity, whatever circumstances in his general method, or in his individual attempts, may serve as lessons to the modern lithotomist, will be best understood by comparing his incisions with the anatomy of the parts. He performed a daring incision by no rule: he operated with a round staff or with a tubulated catheter: he operated, as Heister informs us, often with a pointed table-knife. "I myself," says Heister, "have heard the Dutch people say, while I was in Holland, that when our lithotomist came hither from France, he at first cut a number for the stone, and would sometimes use a common blunt knife, to perform the operation, when his own incision knife was not at hand *." The manner in which he performed his incision was, by plunging this dagger-shaped knife into the point of the hip (la moignon de la fesse) †: The interest excited by his manner of operating amounted actually to enthusiasm: In place of the tedious and ineffectual dilatations of the apparatus major, this fearless man

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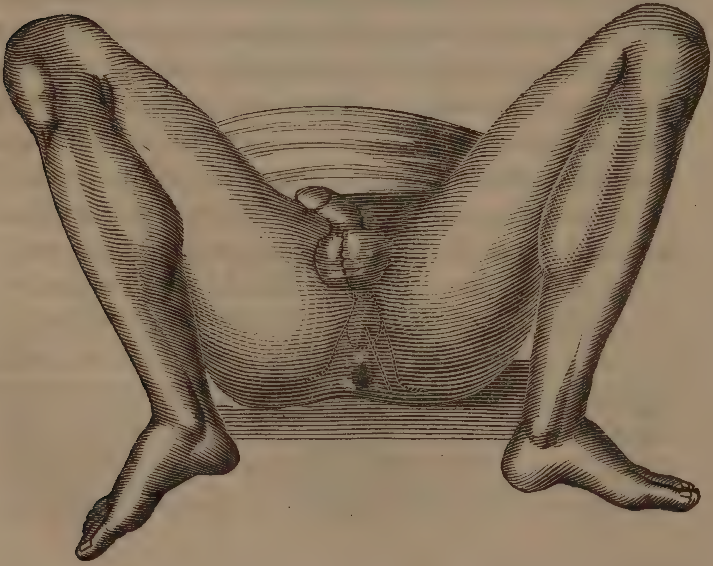
* And in another place he says, "He used a common knife like that which we use to our victuals." The table-knife of France and Holland was a long sharp-pointed clasp-knife.

† "Il tenoit dans cette incision, une autre route que Frère Jaques; car cet hermite poussoit, en aveugle, un poignard obliquement de la partie interne de la tubérosité de l'ischion, jusques dans la vessie; et quand cet instrument meurtrier n'enfiloit pas la vraie route, il en arrivoit les désordres que nous avons détaillés." Garengeot, page 192.

was seen to plunge his dagger into the bladder at once, and almost instantly extract the stone. The essential of his operation was, that it substituted incision to dilatation, and gave the lie to the renowned aphorism which protests that "wounds of membranous parts are mortal."

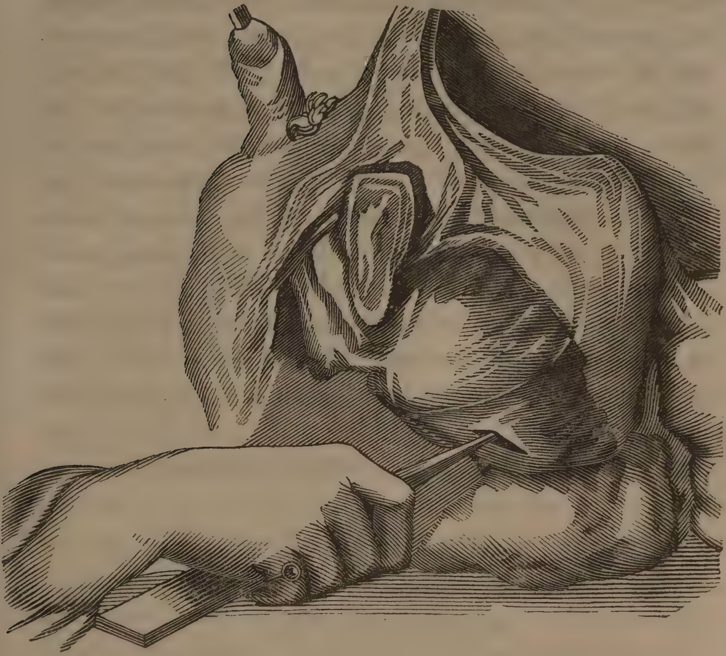
My reader is, I believe, prepared to attribute every thing good and useful to the method itself! every thing irregular, dangerous, and disastrous to the faults of the operator. He is also prepared to distinguish the rude incisions performed at first by this bold but ignorant man, from the masterly operation taught him by Du Verney and Fagon; for the operation which he was then taught forms a period in his life hitherto unnoticed, and an æra in our science:—First, Frère Jaques either remarked himself, or was taught by others to observe, the chief errors of the apparatus major: he was aware that the great mistake was, making the wound in the perinæum over the root of the penis, and not in the hip, over the neck and body of the bladder, for in his own vindication he says, "Frère Jaques had remarked that the dangers and injuries of the old incision proceeded chiefly from the wounding of the root of the penis, where its cavernous bodies join; and that to avoid these dangers the incision should be made in the neck of the bladder:" Behold here the motive for making his incision in the hip, and such an incision must have had all possible facilities, and must especially have ensured the expeditious extraction of the stone: the apex of the hip is the tuberosity of the ischium! When Frère Jaques struck his knife by the side of the tuber ischii, he opened that great hollow which was left closed by its muscles in the incision of the apparatus minor! and the dividing of those muscles is essential (whatever way the operation is performed) to the easy extraction of the stone. By striking the knife by the side of the tuber ischii he divided the transverse muscle: by moving the knife ever so little, to enlarge the wound upwards and downwards, he cut all the muscles entirely across, and opened so completely the great hollow, that every resistance on the part of the perinæum was removed.—This praise of dividing all the muscles, even the enemies of this operation allow him. Mery was surprised into a favourable report; "His incision," says Mery, "proceeds in the middle line, betwixt the accelerator urinæ and the erector penis, without wounding either, and opens all the neck of the bladder and half an inch of its body." This



figure, which I have sketched to illustrate this point, is most important; it is applicable to every species of lithotomy; it is a plan of those muscles of the perinæum of which I have already given a correct drawing; it shows the penis thrown back over the lower part of the belly; the groins much stretched as in lithotomy; the scrotum strongly corrugated; and the dotted lines mark that triangle in which the incision is to be performed. The surgeon must remember that this triangle is bounded by the two legs or branches of the os pubis; that the crura penis arising from these branches lie along the sides of the triangle; that the erectores penis muscles, marked by dotted lines lie upon the roots of the crura penis; that the bulb of the urethra, lying immediately under the middle of the arch of the pubis, occupies all the perinæum from the scrotum to the anus; that on the bulb lies the accelerator urinæ muscle, marked by a dotted line; that the great hollow under the tuber ischii, the centre of this opening of the pelvis, and the only space through which the stone can be extracted, is crossed by the Transversalis Perinæi, and that Frère Jaques's incision is the true incision of lithotomy: first, because it cuts the transversalis perinæi across and does away all resistance on the part of the muscles: secondly, because it completely opens that hollow place by the side of the rectum in which the cervix vesicæ lies, and through which the stone must pass. The line of Frère Jaques's incision is designated by a dotted line; and it is seen that the line of incision passes towards the hip, and that as much of it is behind the anus, or in other words, behind the transverse muscle, as before it; and that such a wound, whether made by a stab as by Frère Jaques, or by, first, a superficial incision, and then a slow dissection as in our manner of operating, is still the true incision of lithotomy: let the surgeon keep these points in mind, and compare this scheme with that which accompanies the operation of the apparatus major.

Secondly, Why Frère Jaques did not use a grooved staff, and how he could use a round one, is matter of difficulty and surprise to many who have described his operation; the description of this part of his operation involves singular consequences, and is the theory of all his misconduct, for he did not penetrate, as we do, by a gradual dissection, stopping upon the face of a grooved staff, but struck his knife at once into the bladder; he went beyond the staff till the point of the knife passed the bending part of the staff and the blade lay across it; as he did not cut upon the face of his staff, the staff was not grooved; as he cut in the bend of his staff, it was remarkably curved at the heel; his knife, when he struck it into the cavity of the bladder, passed through what is called the body of the bladder close behind the prostate gland; and when he drew it towards him to complete his incision, he opened the neck of the bladder and the prostate.—This is an unthought of manner of accomplishing the internal incision; viz. cutting along the bend or concave of the staff. This figure illustrates this incision; where the dagger-shaped knife is laid across the bend of the staff; where the portion of the knife, that is within the bladder, lies in such a direction, that, being retracted, it cuts up the whole length of the neck of the bladder, and the whole of the prostate.

Thirdly, It is matter of surprise how, with a staff



thus passed into the bladder, he could cut the urethra entirely away, or how, the operation being essentially good, such dismal consequences could ensue from his irregular incisions. Morand confesses that he is altogether at a loss to imagine how he could divide the arteries going to the root of the penis, or occasion ecchymosis behind the pubis, and extravasation of blood within the abdomen. The truth is that the incisions of Frère Jaques, in his first operations, were as irregular and dangerous as his incisions in his latter operations were correct and sure. His first operation was rude, unguarded, performed upon a big round staff: it was a stab with his dagger-pointed knife, bold and successful, in so far as regarded the extraction of the stone, but dismal in its consequences as it related to the fate of the patient; in this operation he struck at once into the body of the bladder, and his knife was stopped only by encountering the stone. His second operation, taught him by Du Verney, Fagon, and Hanault, was performed by successive incisions, like those of the modern lithotomist, by which he cut towards his staff: he opened not the body of the bladder, but the prostate; his knife never entered into the bladder, but was stopped by the groove of the staff; it was by running the knife along this groove that he slit up the gland and cervix vesicæ.

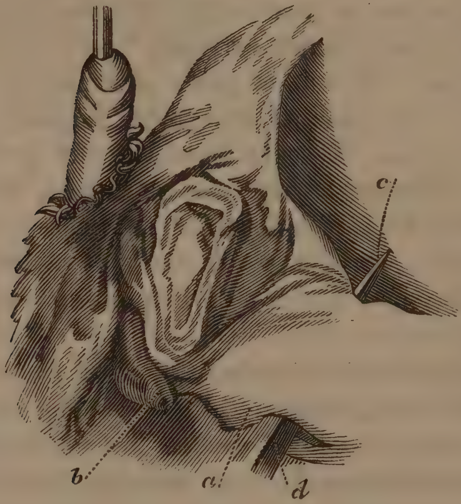
Let us then observe the effects of those two incisions.

ACCIDENTS OF FRERE JAQUES'S ORIGINAL AND UNCORRECTED OPERATION.

To the unremitting, I had almost said the unrelenting labours of Mery, we owe an ample catalogue of the errors which were or might be committed in performing this operation; and there is not one of the usual misfortunes of Frère Jaques's practice that may not be referred to his thus passing his knife over the bend of the staff.

First, In striking in his knife, the distance being great betwixt the hip and the bladder, he often missed his way and mangled the parts by successive strokes. In our modern way of operating we go on by a slow and gradual dissection, because we know the parts! we cut from above downwards, and carry the point of the fore-finger of the left hand before the knife, while we are dissecting with the right! we press aside the rectum, till, in the course of dissection, the knife reaches the bladder safely: he, on the contrary, cut from below upwards, striking his knife at once into the bladder; and his knife, in his more fortunate operations, glided safely by the side of the rectum, to that part of the body of the bladder which lies upon it: but when he deviated from the true dissection, his knife wounded the rectum in passing; this wound, as it caused an issue of fæces and often a fistulous sore, he was not willing to acknowledge. In operating on women, his knife wounded the vagina, and blood flowed from its orifice; but as this was not a mortal nor even a fistulous wound, he spoke of it very slightly and said, "he often wounded the vagina." When, in place of deviating towards the side of the rectum or vagina, his knife glanced upon the bone, it there wounded the great pudic artery, the patient then bled profusely, and sometimes died; for his knife passed, of necessity, betwixt the rectum and the pudic artery, which are but narrow limits for a rude operator unacquainted with anatomy.

Secondly, In drawing back his knife by which he completed the incision of the prostate; his knife, being turned across the bend of the catheter, sometimes projected too far, and transfixed the opposite side of the gland; upon being retracted, it slit up the gland, and membranous part of the urethra on both sides; and in turning over the round catheter at the end of the incision, cut the little of the urethra that remained undivided: thus it often was found, upon dissection, that he had cut the urethra fairly off from the neck of the bladder, and it was shrewdly suspected that where he had only weakened the urethra by this circular incision, he completed the separation of it by pushing against the gland with his clumsy finger, or with a conductor, for he often used one. These are warnings then to the modern lithotomist, in whose operation the same accidents happen by moving the knife with a circular motion, or by cutting the urethra by successive strokes. This posture of the knife laid across the bend of the staff, and transfixing the bladder near the neck, is illustrated by this figure, where it is very obvious,



that in the retraction of the knife from (a) to (b), the urethra will be slit up on both sides, and very little of it left to connect it with the bladder; but if towards the end of the incision, the point (c) of the knife was raised ever so little, and the heel (d) carried round under the catheter, the urethra would be entirely divided.

Thirdly, It must be remarked that Frère Jaques knew that he had struck his knife into the bladder, only by the urine flowing off: the moment the urine flowed off, the bladder was contracted round the knife and the stone: the patient is, during this moment of acute pain, irresistibly inclined to press, as if discharging his urine, and the mere contraction of the bladder, much more the pressure of the abdominal muscles, pushing down the viscera from above, must press the fundus of the bladder against the knife! thence every motion of the knife, in such a condition of the parts, must have been dangerous. The original operation of Frère Jaques, and of his master, Pauloni, was that by the apparatus minor; this operation they continued to perform, and had taken their lateral operation from it, substituting merely the staff as a director for the stone, which alone directs the surgeon in operating by the apparatus minor. They had transferred many of the rules of the apparatus minor to their new operation with the staff, and especially this, that Frère Jaques in feeling with the point of the knife for the stone groped at the same time above the pubis with the left hand, forcing the bladder to contract and press down the stone.—" Thus," says Dionis, " did he often press the fundus of the bladder against the point of the knife."—" He succeedeth better," says Bussiere *, " when the stone is big and large, than when it is small, by reason that a big stone not only

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* Vide this letter in the Philosoph. Transact. anno 1699.

extendeth the bladder, but stoppeth the point of the knife." No one will be surprised, as Morand was, that ecchymosis was found behind the pubis, or extravasations of blood within the pelvis, or abdomen; or that the vessels at the root of the penis were divided; slighter deviations than those described in the operation of Frère Jaques might turn the point of his knife to any of these parts. Neither will the modern lithotomist forget the contracted state of the bladder, when the gorget is driven home into its cavity, for at that moment the urine is expelled, the bladder corrugated, the bowels depressed by the straining of the abdomen, and the fundus of the bladder is in continual contact with the sharp edge of the gorget.

Fourthly, It is particularly worthy of notice; it is a point already touched upon in describing the anatomy of the pelvis, and deserving to be, on a future occasion, more particularly explained; that by cutting thus from the hip towards the body of the bladder, in the deepest part of the pelvis, by wounding more of the body of the bladder than of its neck, there ensue fistulas of the cellular substance, and fœtid sores, which, as much as the more deadly accidents, contributed to bring the operation of Frère Jaques into disgrace.

Of this first operation, then, what can we say, but that it partook of the genius of its inventor, a rude bold man; that it contained the elements of a good operation, but that the operator was exposed to numberless errors, which, for want of education, he could not escape. Frère Jaques, whose operation was successful only in the expeditious extraction of the stone, was, after a momentary enthusiasm in his favour, utterly forsaken, even by his friends, and driven out of the city to go his old course round the provinces.

EXCELLENCY OF HIS SECOND OR CORRECTED OPERATION.

But his second operation was the result of assiduous dissections of these parts. In his new or reformed operation he used his dagger knife no longer, but dissected with an ordinary scalpel upon a grooved staff. The dissection was as simple as that of the apparatus minor, with this difference only, that the projecting of the staff directed the incision instead of the protrusion of the stone. Though by the slow and complete dissection of the parts, the perinæum was completely relaxed, and the transversalis and levator muscles divided; though the external incision corresponded precisely with that of his original operation, yet the inward incision was essentially different: in place of going so deep, or striking the knife through the cellular substance that surrounds the rectum, or seeking the body of the bladder, the neck only of the bladder and the surrounding prostate were cut; and they were divided by a fair, regular, and limited incision, the knife being run through the body of the gland along the groove of the staff. The rectum and the pudic artery were equally out of danger: for the knife did not go so deep, and was not plunged blindly among the parts. The extraction of the stone was easy and expeditious. The external and internal wounds corresponded, and were opposed to each other so that there was no cavity formed among the cellular substance, nor fistulas, nor tedious cures.

His operation was from this time perfect, and for this invention Frère Jaques ranks in that station, universally assigned him by a profession now impartial and grateful, and the operation thus improved by the heads of Fagon and Du Verney, and the bold hand of this operator, was such as left for Rau, and the furious rivals of Frère Jaques, nothing to improve in respect of the design, and, in respect of the manner in which it was performed, every thing to envy. Rau did not improve this operation! it was delivered perfect into his hands! he had indeed the advantage of performing it with the skill of an anatomist, and the courage of an experienced surgeon; but he had the meanness, never to be forgotten, of concealing from the world the precise manner in which he practised an operation which he was taught freely, by one whom he affected to despise, and contrived to ruin.

Thus do we owe to this illiterate man, whose modesty, humility, and courage, whose charity, simplicity, and goodness, we must hold in respect, an operation which has been approved of and performed by all the good lithotomists of Europe; and from his life and fortunes, one important lesson may be deduced; we may learn how slightly we should rely on our natural talents, how little faith we should have in mere courage!—this intrepid fearless man committed nothing but butcheries, while he remained what has been termed a natural operator; but after having undergone the discipline of science, and learned the anatomy of the parts, he became truly valuable.

RAU'S METHOD OF PERFORMING LITHOTOMY.

Joannes Jacobus Rau, the most famous lithotomist of modern times, was born in the village of Baden in Swabia, in the year 1668, of parents far from wealthy; his father a wine merchant, unable to give his son an education suitable to his genius, bound him apprentice, at fourteen years of age, to a surgeon in Strasburg, where he lived three years. At the end of that period, neglected by his parents, and unable to subsist at home, he began to wander far and wide through the world, scantily supplied with the means of travelling, or even with the necessaries of life. After passing through a great part of Germany, he arrived at Hamburgh, and having taken his passage for Bergen in Norway, he then entered into the service of one Frawen, a surgeon; but could not long remain, being unable to endure the extreme cold of that country. It was easy to procure a passage to Amsterdam, for the intercourse was then, as it always has been, very great, betwixt the countries. He accordingly embarked for Holland, and upon his arrival was received as surgeon in the ship of Count Benthem, with whom he visited Spain and various parts. He had the good fortune to arrive again in Amsterdam, at the critical moment when King William was about to sail for England with a gallant fleet, and was appointed surgeon to the vice-admiral Skey's ship.

Thus did Rau spend his first years in an unsettled and miserable way of life, in the society of men rude and brutal; the wages earned thus amidst hardships and perils he did not squander, but hoarded with particular care, whether animated by that sordid passion for gain which strongly marked every future action of his life, or from a more generous desire of renewing his studies and improving his mind, we dare not say. This only is certain, that on his return to Holland he betook himself to Leyden, and there studied all parts of learning with great ardour; and, having made himself acquainted with the doctrines of medicine in that school, he travelled into France, and studied anatomy and surgery in Paris under the best masters: he dissected much with his own hand; Du Verney was his chief preceptor, and Mery taught him the distribution of the nerves: under Myshevius he learned to reduce luxations; and he followed Petit, then an old man of eighty years of age, Marechal, Rowmart, and the great masters of Paris, observing their practice in all the varieties of surgical disease.

Wearied at length of this wandering life, he returned into Holland, and established himself in Amsterdam, where he taught anatomy and practised surgery. While Rau, supported by the magistrates, and supplied with dead bodies, was lecturing in Amsterdam and performing the operations of the hospitals, Frère Jaques by chance arrived in that city, and performed his new operation, which Rau was always present at, and always loudly and violently condemned. These invectives of Rau gave offence at first, and he was obliged to be silent for a time; but the event soon justified his predictions, and induced the magistrates of the city to withdraw their confidence from Frère Jaques, and commit the poor, afflicted with the stone, into the particular care of Rau: he was elected lithotomist of the city of Leyden; his fame and reputation increased daily; pupils came to attend him from all the distant countries, and throughout all Holland he alone was called to perform the great operations, especially that of cutting for the stone. He was soon invited, from a sense of his uncommon talents, to teach anatomy in the public theatre at Leyden; and upon the death of the celebrated Bidloo, he received the crown and last reward of all his labours, being called to that chair which the counsellors and governors of the university and the magistrates of the city pronounced him alone worthy to fill. Rau now forsook, with great reluctance, the society he enjoyed in Amsterdam, where he had lived happily with his friends; the little pleasures and indulgences he enjoyed had become with him a second nature; he could not but foresee many unhappinesses arising from this sudden change in all the habits of his life, and the loss of those friendships which had been the chief pleasure of his leisure hours.

Yet he accepted the place: he was, in the year 1713, installed in his office, and pronounced his celebrated oration on the teaching and improvement of anatomy; and soon after he attained the highest rank in the university, being elected Regent.

The labours of this station he undertook while in perfect health and vigour; nor did he ever relax in the arduous duties of his office while health and strength remained. But it unfortunately happened, about four years before his death, that, by a fall, he sprained his foot. At such a period of life, after many years spent in study and labour, the spirits and health and whole frame of mind are apt to be affected by the most trivial cause. The pain occasioned by this accident confined him for several months to bed, and when the pain ceased, an oedema remained. The long silence and solitude of confinement succeeding to the bustle of an active life, brought on melancholy and hypochondriasis; the paroxysms of this most afflicting disease were for two years frequent and dismal; and the year before his death he sustained a stroke of apoplexy. From this period, his health and bodily frame was entirely ruined; he was afflicted with ringing in the ears, an evening fever, and night sweats, by which his strength was exhausted. His melancholy increased to the most afflicting degree; the slightest noise alarmed him; the ringing of bells, the crowing of cocks, the voices in the streets, brought on intolerable anxieties, till at last this melancholic delirium ended in madness: he, after four years of suffering, expired, loaded with fame, riches, and honours, beyond his most sanguine hopes: he died on the 18th of September, 1719, and was buried in the great church of Leyden.

"Rau was of a robust and manly form; his countenance somewhat severe and stern: he was of a generous, active, and fiery spirit; ingenious, laborious, covetous of honour, seeking it, not by art but by his own honest deserts: he lived an unmarried life, sober and frugal, yet he was generous and cheerful with his friends: he was incapable of flattery, dissimulation, or cunning, unsparing in his censures, diligent in correcting those errors which affected his profession, severe in his invectives, especially against those who erred in matters of science; but this spirit we ascribe not to a love of satire, but to a certain enthusiasm and love of truth, and to a proud confidence in his own natural powers. To remember his boisterous manners or rude speech as a subject of reproach were most ungenerous, for he lived a miserable and wandering life during those early years in which the mind, soft and pliant as wax, receives too easily the impressions of surrounding objects, and is formed by chance and by the society in which we live! no, it is rather a matter of wonder that he became so great a man *."

These are the slight memorials left us by Albinus of the celebrated Rau: his spirit of enterprise and love of science; his diligence in study, and his frugal and simple way of life; the fortitude with which he resisted the corruption of bad example, and the steadiness with which he reserved the earnings of a severe and laborious profession, to enable him to renew his studies at an advanced period of life, are most commendable. The perseverance with which

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* "Fuit autem corpore magno et robusto, egregiaque et virili plane forma, vultu severo, et torva nonnihil tuente. Fuit animo generoso, promto, et alacri; totus tamen paulo fervidior atque commotior. Cæterum ingeniosus, laboriosus, et attentus; atque gloriæ semper cupidissimus, quam non arte sed aperte palamque meritis suis acquirere studebat. Vixit in cœlibatu, parce et sobrie; libere tamen, et cum amicis hilarus. Adulari admodum non poterat, neque sustinere diu simulationem. Itaque minime facile et diu parcere solebat, sed alios reprehendebat. Errores evellere conabatur; in multos vehementius quoque invectus, præsertim si quos in sua arte à vero abesse existimaret. Quod eum non tam carpendi aut lædendi libidine fecisse credimus; quàm veritatis asserendæ et defendendæ studio atque impetu quodam, et quòd non prorsus abjecte de se sentiret."

he struggled, during the early part of life, against penury and want, the res angusta domi, gave proof at once of his excellent genius and consummate prudence. "The noblest blood in all the land 's abashed, having no lackey but pale poverty*." He studied anatomy, not by reading nor by dissecting animals, but by dissecting the human body; this he regarded as the first and most essential point of his education, and spared no expense, no travail, no solitary labour, to attain to a perfect knowledge of the structure of the human body: he was soon distinguished as the first surgeon of his age, and certainly was the most celebrated lithotomist that ever lived. Before publishing his oration, he had cut one thousand five hundred and forty patients for the stone†. His operations were attended by students from all parts of the world, and after his death his method of operating was imitated by all the surgeons in Europe. One thing is ever to be lamented, that this great man had contracted, in his years of penury, not merely habits of laudable economy, and a decent respect to the necessary affairs of the world; he was visited early in life with that mean vice which eats up every virtue, grows continually as we advance in years, and in our liberal profession destroys the seeds of charity and every generous sentiment. This sin of uncharitableness, Albinus his friend and favourite would fain conceal; but whatever might be due to Rau from his fellow citizens, from those who felt the immediate benefit of his skill, on posterity he has no claim! his sordid temper made him commit an unpardonable crime against his profession, and the interests of humanity: he concealed his operation to the very moment of his death!

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* "Haud facile emergent, quorum virtutibus obstat
Res angusta domi."

† To cut one patient daily it would take him three years to accomplish this number; but even this surprising number he had cut at an early period of his career. It is probable that as he cut almost every day, he had cut to the number of three thousand and more during his life.

When first Rau cut for the stone, he performed the Marian operation with all the apparatus, opening the urethra by cutting, as he had been taught in Paris, upon the perinæum, not upon the hip. When Frère Jaques first appeared in Holland, Rau was by virtue of his office and by authority of the magistrates present at his operations, and had the privilege of opening the bodies of those who died; from him he avowedly learned the operation which he afterwards performed, and it will be recollected that Frère Jaques, at this time rude and ignorant of anatomy and all the scientific rules of operating, struck his dagger-like knife into the body of the bladder, cutting from the point of the hip. Rau had no higher ambition at this time than to correct the irregularities of this mode of incision; and he professedly divided, in his new operations, the same parts which were divided by Frère Jaques. "His design was not to divide the neck of the bladder as in the earlier operations, nor the urethra as in the usual operation of the apparatus major, but the body of the bladder near its neck, towards the side and lower part; an incision (says Albinus) which could not well be attended with any greater danger than those in which the urethra or cervix are cut; and since in this incision the cervix vesicæ is left entire, neither wounded with the knife nor dilated with instruments, nor cruelly lacerated in extracting (as often happens) a large and rugged stone, the operation could not fail to be infinitely safer than that in common use."

"Propositum in hac operatione erat, non cervicem vesicæ incidere, ut primo fecerant, nec urethram, ut eo tempore plerique solebant, sed vesicam ipsam, proxime cervicem ejus, à latere, nonnihil inferiora et posteriora versus. Quæ quidem vesicæ sectio periculosior per se multum esse non poterat, quàm vel cervicis, vel urethræ. Et cum sic urethra et cervix integra manerent, et neque instrumenta introducendo et vi magnâ diducendo, neque etiam calculum, magnum sæpe et scabrum asperumque, violenter et crudeliter plane extrahendo, via hac necessario angustæ partesque tenerrimæ læderentur; et multa quæ hæc consequi fere solent maximaque mala præcaverentur, longe vulgaribus antecellere videbatur."

This, his new operation, Rau performed with all the advantages of anatomical knowledge and surgical skill; but he could not be long insensible to the dangers of an incision which passes not through the prostate gland and that part of the bladder which is the most directly opposed to the external wound, but into the body of the bladder behind the gland, at the part where the bladder lies deep within the pelvis, and is almost inaccessible to the most dexterous surgeon. While Rau was meditating on these dangers, and conscious of the ill consequences inevitably resulting from this deep incision, Frère Jaques appeared again, and it will be recollected that he now performed a new operation corrected by Fagon and Du Verney. "He had," as he whispered to Salzmannus, "left off his former rash way of operating, and cut now upon a grooved catheter." He cut not into the body of the bladder, but into the neck of the bladder, through the substance of the prostate gland. This was the operation which Rau learned and adopted; the use of a grooved catheter was the sole invention boasted of by Rau or claimed in his favour by his pupil Albinus.

"Itaque negari quidem non potest præivisse Rauio Fratrem Jacobum: hoc tamen ei hodieque et semper esse debet laudi maximæque gloriæ, quòd peritia, ingenio, et industria sua, id addiderit, quo solo curatio, cæteroquin incerta, periculosa, et plerumque perniciosa, reddita est certa, tutior, et cæteris forte melior et præstabilior. Addidit autem catheterem, ut vocant, qui gibba sui parte sulcum profunde infissum haberet; quem per urinæ iter in vesicam demitteret, et ad vesicæ locum, qui incidendus erat, gibbo suo apprimeret, ut eum cultrum porro dirigere, supra eum vesicam certo incidere, instrumentaque pro forcipe tutò rectàque dirigenda immittere posset, plane ut apparatu magno fieri solet."

By the valuable lessons which Du Verney, Fagon, and Felix, gave to Frère Jaques, and by his confession to Salzmannus, of an entire change in his operation, Rau was excluded from every claim as an original inventor; yet, as by his talents for operating he had become famous when Frère Jaques was dead, and he alone left to perform the operation, it became to him a sort of property; he was supposed to have a peculiar method of his own; it was believed that he alone, of all the surgeons in Europe, knew the true method of Frère Jaques, the art of cutting with safety into the body of the bladder, behind the gland. He had indeed done so in his first operations; and now his reputation being involved, it became his interest to deceive the profession into a belief that he continued to perform this juggling trick of cutting entirely behind the prostate gland.

We are now arrived at that part of our narrative which we enter upon with reluctance. Rau had learned his operation from this open and ingenious man, "whom he affected to despise and conspired to ruin;" the sin of his ingratitude stands indeed the most prominent point in his character: but there is another accusation of a blacker die; his sordid temper induced him to do a deep and irremediable injury to that profession of which he was a sworn supporter. Rau, a man of science, a professed teacher of youth, whose appointed office it was to instruct them in the manner of performing surgical operations, refused to explain this operation in which he particularly excelled. Heister, who was among the pupils of Rau, seems to have felt an honest indignation at his conduct, and has commemorated the sordid temper of his unworthy master. "Rau," says he, "alive only to motives of gain, concealed his operation from all his pupils, and from myself; he would not teach us how to perform it, lest his own profits should be lessened; a meanness which every man of dignified sentiment must hold in contempt, preferring sincerely the public welfare to his private gain*." All the profession was disgusted with his sentiments and conduct: his expressions were equally mean, rude, and unmannerly: he told his pupils, "that as for this operation, he was to gain his bread by it, and never would say one word about it as long as he lived; and that if they did prevail with him to speak on this subject, they would do wisely not to believe what he said." These were the familiar and blunt expressions of this rude man, who often, however, condescended to use more polite and scholar-like expressions, saying to those who asked him to disclose his secret, "Legite Celsum." His secret! he had no title to reserve from the world one point of knowledge even the most trifling: he was equally bound by humanity and duty to disclose his operation: the patrons of the university, and the magistrates of the city, in appointing him to so high a charge, bought his time, his talents, and all his petty secrets, with honours of which he showed himself but little deserving.

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* Hoc olim celavit valde ad rem attentus Ravius, suis discipulis, et inter hos etiam Dom. Præside (viz. Heister), dicendo se eos suam methodum non docere, ne scil. eam damnum postea inferrent: à qua vero turpi invidia vel avaritia, vir bonus, honestus, et cordatus ex

The anxiety of the profession to discover the operation of Rau never ceased, and those were held in some estimation who were supposed to know and practise it. Dennis, a surgeon in Holland, took advantage of this temper, and made one experiment more upon the credulity of the public; he gave the public to understand that Rau whispered to him, with his dying breath, the full and true account of

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Dom. Præsidis sententia debet ipse quam alienissimus et potius pro utilitate publica, quam pro propria sollicitus esse."

"Enchyreses suas celabat Raavius quærentibus, dicens aperte victum inde sibi petendum esse, adeoque dum viveret, nihil de hoc se patefacturum esse, et si quid etiam dicere cogeretur, verum non dicturum esse." Breyer, page 495.

his operation, and that he, Master Dennis, continued the depository of this important and beneficial secret. The sordid motives of Rau appear infinitely more offensive in the person of this his wretched follower: his book, intitled Observationes Chirurgiæ de Calculo, is apparently an earnest exposition of the dangers of the operation by the apparatus major, and a fair parallel of it with the lateral incisions of Rau; while it is in truth but an advertisement unworthy of a mountebank. This boasted operation Dennis never has the honesty to describe, from the beginning to the conclusion of his treatise; the only passage in which he mentions the operation, is this: "Concludo itaque methodum Rauianam, qua jam duodecim annis utor, optimam esse omnium huc usque inventarum." Whoever reads attentively this book of Dennis, will not wonder at this sentence, nor expect a work like his to come to any more worthy conclusion. He designed merely to persuade the world that the operation of Rau was the best possible, and that he, Mr. Dennis, knew how to perform, and had actually performed it for twelve years*.

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* Dennis published this insignificant book in the year 1732: the sentence quoted above is, to the best of my recollection, the only one in which he mentions the operation of Rau. He never describes it: I am persuaded he could not perform it; even this piece of cunning and his twelve years experience in operating, never brought him into repute. The tale he tells is, I believe, a falsehood; for however much he might be the favourite of Rau, his secretary, his confident, his assistant in operations, he knew nothing of what Rau did; he had but the disgusting duty of assisting an operator whose confidence he did not enjoy. If Rau was jealous of his pupils, would he not be jealous of so excellent an operator as Dennis? His assistants were those against whom he had chiefly to be upon his guard, and I am persuaded that he kept his secret from none so carefully as from Dennis, who sometimes, and from Albinus, who often assisted him. That Dennis received the account of this operation

While Dennis was thus repeating the offence and making a secret, in his turn, of the secret operation of Rau, the interests of humanity were suffering! all the surgeons of Europe employed themselves in learning, by dissection, this mode of incision, with no other guide than a confused tradition that Rau had opened only the body of the bladder behind the prostate gland! while many were making experiments in hospitals, by which innumerable lives were lost. Those made in England were attended with the most dismal consequences, and the celebrated Chesselden was the man who had to lament and to confess the errors he had committed in attempting to imitate Rau.—" Rau," says Chesselden, " succeeded wonderfully; and if he, who was an excellent anatomist, may be allowed to have understood his own operation, it was directly into the bladder, without wounding either the urethra or the prostate. Besides this,

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from Rau upon his death-bed, is inconsistent with every authentic history of the last hours, or even of the last years of this celebrated man, who lingered in a state of melancholy, and died in paroxysms of delirium and insanity. A death-bed is indeed a time for telling secrets, but not of this nature: if the old gentleman had had a thousand pounds hid under a tile, as might very naturally be, he might have told such a secret to Dennis, who would have been fully as glad of this kind of secret as any other man; but that Rau should sit up in his bed in articulo mortis, take off his night-cap, and, holding master Dennis by the two hands, explain to him how to cut for the stone, is very unlikely.

Amsterdam has been, for time immemorial, the emporium of surgical secrets; the lever of Ruinhuisen, the fillets and parturient pills of various discoverers among the Dutch, the undivulged arts of the celebrated Ruish, the mummy-making secrets of Bills, who boasted that he could preserve bodies either soft or hard as he pleased, and as fresh as if alive, are a sort of vindication of Rau and Dennis. It was the fashion of the times, and this was a country where they held a great trade in secrets, and were ashamed of nothing that was any way profitable.

other competent judges who were the witnesses of his operations have borne the same testimony *."—"Hearing then of the great success of Mr. Rau, professor of anatomy at Leyden, I determined to try, though not in the same manner, to cut directly into the bladder; and, as his operation was an improvement of Frère Jaques, I endeavoured to improve upon him by filling the bladder, as Douglass did, in the high way with water, leaving the catheter in, and then cutting on the outside of the catheter into the bladder, into the same place as upon the gripe, viz. in the body of the bladder, which I could do very readily and take out a stone of any size with more ease than the other way †." Thus was our great surgeon (not yet trusting to his anatomical knowledge, nor inventing an operation for himself,) seduced by this rumour of the success of Rau, and of the depth of his incision; and by cutting thus deep behind the gland, Chesselden had the unhappiness to see many of his patients die, sprawling upon their belly with pain and agony. "My patients seemed," says Chesselden, "for some days out of danger, but the urine which came out of the bladder continued lodging upon the cellular membrane on the outside of the rectum, attended with a vast discharge of stinking matter, and from this cause I lost four patients out of ten." Chesselden, while attempting this innovation, saw, with vexation, scenes of terrible suffering: we find, by his own report, that after this operation, gangrenous abscesses and tedious sores ensued; that his patients sometimes sprawled upon

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* Anatomy, page 326.

† Ibid. page 328.

their bellies for a fortnight, writhing with agony, and suffering something like a paralysis of the lower extremities; from the extremity of pain * after such misfortunes, arising from the mean and covetous temper of Rau, it is impossible to think of him with respect.

We cannot read what Sandifort has delivered to us of the history of Albinus, without lamenting that he should have been long the assistant without ever becoming the confident of Rau. The assistant is to the surgeon as a friend, adviser, and counsellor, in all the difficulties of his operations, to whom he must entrust, in some degree, his own reputation and his patient's safety, and to whom he owes in return every sentiment of confidence and friendship. What shall we think of Rau, who kept even the celebrated Albinus an alien from his thoughts, and used him as a common assistant, as an unintelligent instrument in his hands?

" While Rau was a lecturer in Leyden, Albinus attended his lessons with so much assiduity, that Rau, captivated with his personal attachment and enthusiasm in science, willingly communicated to him every thing that was new or interesting. He was so pleased with Albinus, that in difficult cases, and in all surgical operations, he chose him for his assistant, especially in operating for the stone. This operation, although improved by Rau, and performed by him more than a thousand times successfully, he never yet revealed. But such opportunities had Albinus of remarking every step of the process, that

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* Vide Appendix to the Anatomy, page 330.

no one ever did nor ever could describe his operation so correctly." These are the words in which Sandifort describes the affection of Rau for his celebrated pupil Albinus. Yet these are but slender grounds for the confidence with which Albinus has written the history of Rau's lithotomy. He could not be otherwise than extremely desirous to learn the essentials of that operation, in the performing of which he was so often a party; he believed he understood it; he wrote freely what he knew; but we shall find in the sequel that he was deceived; and it marks only more disgustingly the cunning of this Rau, and the pains he took to deceive, that he was able thus to impose upon the greatest anatomist of the age.

These traits of character are not without their use. I am conscious that till I had investigated the history, and obtained, as it were, a personal knowledge of these great men; till I had reflected on their motives, and weighed their talents and disposition; I never could form a decisive choice among the operations they performed. I am sincerely desirous that my reader should be acquainted with the opinions of the profession; with the men who supported the reputation of surgery in its most flourishing æra! when anatomy was cultivated, and operations originally projected and executed by those who were thoroughly acquainted with the anatomy of the parts! when Albinus, Rau, and Chesselden, were the first surgeons in their respective countries! when lithotomy was thoroughly studied, and the peculiar advantages and faults of each method discovered both by experience and by dissection.

The authorities I now proceed to quote shall be plain and direct, and shall relate to that point solely which is the most important of all, viz. whether the lithotomist should cut into the body or into the neck of the bladder, and in what form the incision should be performed.

When the memoir of Albinus was first given to the world, thus stood the doctrine: That, in cutting for the stone, it was especially desirable to spare the neck of the bladder and the surrounding prostate: that, these parts being left entire, fistula and incontinence of urine would be as impossible in cutting from the perinæum, as in cutting by the high operation above the pubis. This was a short-sighted precaution; for this very form of incision, which it was imagined must prevent fistulas, was the certain cause both of fistula and of every other danger.

The history of Rau's lithotomy, as delivered by Albinus, served to impress this prejudice more strongly upon the public mind. His narrative seemed to prove that Rau had operated according to these principles, and in imitation of the deep incision of Frère Jaques. Albinus, adding his own authority, argued that "the wound of the body of the bladder could not be more dangerous than that of the urethra or cervix, and that good anatomists could find no difficulty, at least no insurmountable difficulty, in cutting thus deep into the pelvis."

"It was the design of Rau," says Albinus, "to divide not the neck of the bladder, as in the earlier operations, nor the urethra, as in the usual operation, by the great apparatus, but the body of the bladder itself near the neck, a little to one side, and towards its lower and posterior part; an incision which surely could not be more dangerous than that of the urethra or of the cervix: and since, in this way, the urethra and the cervix are left entire, neither wounded with the knife nor dilated with instruments, nor cruelly lacerated by the extraction (as often happens) of a large and rugged stone, this incision could not but be infinitely preferable to that in common use. Yet this incision, though in itself safe, is difficult to perform, since this part of the bladder lies very deep, only to be reached when the patient is laid supine, his knees raised, his thighs moderately bent, and held asunder. Then, by cutting first the skin by the side of the anus, next prosecuting that incision obliquely inwards and upwards, the knife, thus directed, reaches the destined part of the bladder; and if these various incisions be correctly made, there is no part in the way of the knife to create any real or insuperable difficulty, though, no question, both the thickness of the skin and muscles to be dissected, and the proximity of important parts which we must not wound, make this a very critical incision. Should the surgeon cut too deep, or decline ever so little from the true course of the incision, he is in danger of transfixing the bladder, or of wounding the rectum, the vesiculæ, or the mouth of the ureter, the erector muscle, or the cavernous body of the penis, where it arises from the pubis: the urethra, too, may be wounded or entirely divided from the bladder. Nor is all safe even after the incisions are rightly performed; for in so oblique a wound the forceps are apt to glide to one side, and in place of entering in the right direction into the bladder, separate the adjacent parts, and then the surgeon, opening the forceps, and searching in vain for the stone, seizes whatever is interposed betwixt the forceps and the stone, and not only fails in his operation, but, by lacerating the parts, brings the patient into imminent danger. Such misfortunes are well known to have happened in the practice of Frère Jaques, who, being ignorant of the structure of the parts, had no rule to guide his knife or forceps by. Far from approving of his operation, I scruple not to affirm that his invention was dangerous to humanity, and often fatal to the individuals who fell into his hands: better had it been that his method had never been imagined, were it not that it suggested to the celebrated Rau a more perfect operation; for Rau, thoroughly skilled in the anatomy of the parts, knowing correctly what parts should be wounded and what avoided, was sensible that nothing was wanting to render Frère Jaques's operation perfect, except regulating the plan of the incisions so as to carry the knife fairly and directly to this part of the bladder; and such a form of incision did he invent and perform most successfully.

"It cannot, indeed, be denied that Frère Jaques was his master; yet to Rau alone is to be ascribed the merit of having, by his knowledge and genius, made that mode of incisions, hitherto the most fatal or dangerous, the most successful and certain of any, giving it a superiority over all others. Rau added to the apparatus of Frère Jaques a grooved staff: this staff he passed down the urethra, pressing its convexity so firmly against the part of the bladder that was to be opened, as to be felt in the perinæum: upon this he cut his outward incision; to this point he directed his knife, and upon this projecting part of the staff he opened the bladder with certainty, and along this grooved part of the catheter he passed his conductor, and along the conductor the forceps were introduced, as in the apparatus major. But seeing that the staff used by those who cut upon the perinæum was too slightly curved to be easily pressed against the body of the bladder, he invented a staff differing in these respects from that in common use: First, where the shaft of the staff ends, and the groove and the curvature of the staff begin, the angle was very acute: Secondly, the staff from the angle forwards was elongated into a straight beak, that the operator might cut boldly along this part of the staff, and, by moving his knife backwards and forwards, open the bladder with an ample wound. These were improvements naturally suggested to him by comparing the anatomy of these parts with the general scope and design of the operation."

So much for the design. As for the manner in which he performed his operation, it is explained to us by Albinus, his favourite assistant, in the following words:—"Having placed his patient in the usual manner, and passed the staff, he took the handle of it betwixt the finger and thumb of the left hand; he inclined the handle steadily and gently towards the right groin, and pressed it down upon the belly, so as to press the curve of the staff (which in that posture lies in the neck of the bladder) close against the part that is to be cut, which, as has been already explained, is near the neck, towards its lateral and posterior part: pressing, then, the staff from above against this point of the bladder, he felt for it from below with the point of the right thumb, (pressing against the soft part of the buttock to the left of the anus, betwixt it and the tuber or bump of ischium, on which we rest in sitting,) and by pressing alternately the staff downwards with the left hand, and the thumb of the right hand upwards, he felt the curve of the staff distinctly, and marked the place of the first incision: his mark was an inch or two finger breadths to the left of the anus, not nearer, lest he should touch the rectum; nor farther off, lest he should be obliged to make his wound too oblique. Yet, according to the age of the patient, or the feelings of the parts, his incision varied; he cut his external incision sometimes high, sometimes low, sometimes nearer, sometimes farther from the anus; the curve of the catheter always sufficiently denoting the elected point of the bladder. His external wound of the skin and fat he made from above obliquely downwards, inclining somewhat towards the tuber ischii, to avoid the rectum; but about this external incision he was by no means solicitous. As soon as the incision was made, he introduced into it the thumb of his right hand, or the fore-finger, feeling carefully for the catheter, turning the catheter at the same moment with the left hand, so as to place the curve correctly against the part of the bladder that was to be opened. Having marked the place of the catheter, he withdrew his thumb, and introduced the point of his knife, but not deep, carried it cautiously towards the curve of the catheter which he had just before distinguished with the point of the finger, and made his way towards it by dissecting carefully all the intervening fibres; and lest, in the course of this little dissection, he should wound the rectum, he usually introduced his fore-finger into the anus. When by dissecting thus he had nearly reached the bladder, he introduced the finger or thumb once more into the wound, feeling for the staff and adjusting its posture, if it had been displaced by any motion of the patient; and once more marking the precise position of the curve of the staff upon which the bladder was next to be wounded! he moved with the greatest precaution, intreated the assistants and the patient to be steady! The staff he held steady with the left hand, and with the right he introduced the knife, and with the point of it he touched the staff, but without cutting, only holding the point directly towards the staff! Then he, with the utmost circumspection and caution, struck the point of the knife into the groove of the staff, and was satisfied that he had accomplished his part of the operation when the knife and the staff encountered each other, and when he could feel, by moving the knife from side to side, that it was fairly engaged in the groove. Then moving the point of the knife cautiously and steadily upwards and downwards in the groove, but more particularly downwards, and turning the staff skilfully so as to favour the knife, he opened the bladder with a wound not remarkably wide." "The position of the staff regulated the course of the wound, and directed it somewhat downwards and outwards; a direction which was necessary to prevent wounding important parts. His next care was to prevent the staff slipping out of the wound, and, by introducing his finger, to ascertain its size and feel it naked."

Albinus, in this description, first plainly delineates the plan and theory of this operation. "It was the design of Rau to cut, in imitation of Frère Jaques, the body of the bladder near the neck." Non cervicem vesicæ ut primo fecerunt, nec urethram ut eo tempore plerique solebant,—sed vesicam ipsam proximè cervicem! and this word proximè is so absolutely exclusive of the neck, that a more decided or more irrevocable word could not have been used. He next explains the innovations proposed by Rau, viz. the using a grooved staff with an acute angle at the place of its bending, and a beak so long as to lie deeper within the body of the bladder, and which, being pressed steadily downwards, should project that part of the bladder which was to be opened, and be easily felt in the hip, betwixt the tuber ischii and the opening of the anus. And, thirdly, he explains how the operation is to be executed by making a large and free incision, dissecting cautiously forwards towards the catheter, feeling it distinctly, placing it fairly, and opening the bladder by running the point of the knife backwards and forwards along the groove of the staff, but chiefly backwards. In the course of this long, interesting, and most circumstantial description, the body of the bladder is mentioned repeatedly, the prostate gland never; the cervix or urethra once only, and that in contradistinction to the parts that are to be cut. "This is a wound certainly not more dangerous than that of the urethra or cervix." Could it be believed that after declarations so express and decisive, Albinus should, in his latter days, in his days, I believe we may say, of imbecility and dotage, deny that he ever had represented the operation of

Frère Jaques as performed by an incision through the body of the bladder?

No sooner was the operation of Rau announced to the world by so great a man as Albinus, a skilful anatomist, the pupil, friend, and assistant of Rau, than all the surgeons of Europe entered upon the enterprise with absolute confidence of success. The experiments of the best anatomists were attended with the worst consequences; not only did they rarely succeed in cutting into the body of the bladder, but there was an irregularity in the effects of their incisions very difficult to account for. "I performed," says Mr. Morand, "many experiments according to the very letter of the book (viz. the treatise of Albinus); the experiments were made in presence of Messrs. Molinelli, Condoidi, and Pringle; one read the words of Albinus, another held the subject, while I performed the incisions; and, though I operated with the same instruments, the same assistants, the subject carefully held in the same posture, my incisions took place in very different parts. First, In one body we found the great prostate divided two-thirds of its length. Secondly, In another body was divided part of the prostate, and what is usually called the neck of the bladder. Thirdly, In a third subject we found that the knife had entered the body of the bladder in the middle betwixt the ureters. "Whence," says Morand, "we may infer, that since Rau did not choose to explain his method, no one could know how he conducted his knife, when within the wound, nor through what parts *." Morand was persuaded that

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* Morand, page 102.

Rau had never cut thus behind the prostate gland, but had performed in effect the operation of Celsus, cutting the neck of the bladder only, and not the body. He remonstrated with Albinus on the imprudence of his report; and this was the first shock his vanity had received: he was from this moment conscious that Rau had kept him a stranger to his operation, and sensible of the full extent of the injury he had done to science: by describing, with so much confidence, an operation which he did not understand, he had led the whole profession into a course of experiments full of danger.

Garengeot, who was tormented with an eternal desire to learn every thing! to try every thing! to publish every thing! next made experiments similar to those of Morand. "We tried next day," says Garengeot, "four more operations, to ascertain whether we could actually accomplish the operation of Rau, as taught by Albinus: we tried whether it was possible to open the body of the bladder alone; but whatever pains we took in giving sufficient curvature to the staff, and in pushing the bistoury deep, with the design of striking it into the extremity of the groove, we found insurmountable difficulties: in every succeeding experiment, we approached nearer and nearer to the pudic artery, the wounding of which occasioned the death of one-half of the patients of Frère Jaques; the left side of the prostate we never were able to avoid, and, in dividing it, we of course wounded the cervix: in short, it was rather from examining the internal than the external surface of the bladder, that we satisfied ourselves of having opened the body of it. Thence we are persuaded that Albinus never examined bodies operated on according to his own rules, and that, had Rau himself described his operation, he never would have ventured to affirm that he saved the urethra entire, and opened merely the body of the bladder! The knife can never reach the body of the bladder but through the urethra, except in these cases of retention of urine where the bladder, being greatly distended, projects on either side, and presents itself to the knife."

Conscious of something wrong, and thus assailed, Albinus could no longer refuse those explanations which the profession required. Chesselden had declared it dangerous to attempt the operation which he had described; difficulties had been proposed on all hands; and by Camper, his pupil and his rival, he had been questioned in a less friendly way; the best surgeons in Europe had attempted, in vain, to perform the operation which he described; so that some explanation was now due, both in deference to the public opinion and for the sake of his own reputation.

Thus publicly and plainly charged with his rashness, Albinus entered upon his exculpatory evidence, as the last solemn act of his life. He denied the charge with vehemence, and claimed the privilege of explaining the words quoted by Sharp and Camper in his name, and this is what he says: "I never did affirm that Rau cut the body of the bladder, but that such was his design (propositum fuisset)." "This term cervix, authors of various ages have understood variously. Le Dran and others understand it to be the beginning of the urethra, where that canal departs from the neck of the bladder. ‘ The urethra,’ says Le Dran, ‘ assumes various names at the several distinct points; its beginning is named the neck of the bladder, and when the bladder is fully inflated, this neck forms a conical or funnel-like canal, leading to the bladder.’ Such,” says Albinus, “ is the description of the part understood to be wounded by Rau. What else, indeed, were we to understand? for Rau himself, when questioned concerning his operation, said ‘ Legite Celsum;’ and surely Celsus directs the neck of the bladder to be opened.” “ I have,” says Albinus, “ in a patient cut by a surgeon of our city, according to the method of Rau, introduced my finger into the bladder, and perceived distinctly the orifice of it still entire, the incision extending exactly to the orifice; to make such an incision is much more difficult than to open either the urethra or the cervix, for this part of the bladder lies deeper, and is not so tense on the staff.” “ One surgeon of our city, Bortile, an ingenious and skilful operator, assuredly cut after Rau's method, though it is reported that he cut rather higher, the patient being laid more supine. His operations,” says Albinus, “ I have often witnessed, nor do I think there can be the smallest doubt that he cut at once the orifice of the bladder, the neck, and the contiguous part of the body. Chesselden, at the distance of many years, cut exactly the same parts. Perchet, Morand, Heister, and many others, cut not the body only, but also the cervix; and Heister, in an especial manner, endeavoured to imitate, both upon the living and the dead body, the operation as he had seen it done by Rau. Our modern surgeons, besides, continue to operate according to the design of Rau, and of Bortile after him. And I have myself (says Albinus) demonstrated the same plan of operation to my pupils, on the dead subject, both before and after the biographys was made public."

Thus had the common voice of the best surgeons and anatomists, in various countries, declared it impossible or dangerous to perform the operation imputed to Rau. Albinus, still alive, and in extreme old age, was called on to avow, or to refute, the charge of ignorance and imprudence, and most willingly would he have wiped off the reproach. But here, in his eagerness to exculpate himself from the charge, he mentions one proof which Camper directly and flatly contradicts. "Never," says Camper, "while I was the pupil of Albinus, did he demonstrate the parts wounded in this operation! Every year he performed on the dead body, and explained to his dissecting pupils the operation of Rau, but without demonstrating the parts, or even opening the bladder from the side of the abdomen. Nor could I, from his instructions, form the slightest opinion on this point, of such high importance to humanity."

Thus did Albinus, in his latter years, strive to save his reputation from this notorious blunder; he tried by implication, and circumstantial proof, to take off the force of words too plain to be misunderstood, and too deliberately pronounced to be recalled in any other way than by an open ingenuous avowal of his fault. His words made unhappily this uniform impression on the minds of surgeons in all parts of Europe, that Rau did cut the body only of the bladder, behind the gland: it was known to Albinus, for many years, that on the sole authority of his description, this was universally believed. "He acknowledges that he understood it to be the design of Rau to cut boldly into the body of the bladder, near the neck;" whether Rau was or was not able to accomplish this design, whether he could open the body without in some degree touching the neck of the bladder, is a dispute unworthy of a man of honour. Rau designed to open the body of the bladder, and all the surgeons of Europe endeavoured to follow his example; their career was interrupted only by the difficulties of that deep incision, by the dangers of it, and (melancholy to relate!) by the death of numbers of their patients. The result of Chesselden's experiments has been already explained: what may have happened in the practice of others less dexterous and less ingenious, we do not know; but it is greatly to be feared that innumerable deaths are to be ascribed to the precipitancy and vanity of Albinus, and to the mean and sordid temper of Rau.

SECTION III.

CONTAINING THE HISTORY OF THE LATERAL OPERATION, PROOFS OF ITS EXCELLENCY, AND PLAIN INSTRUCTIONS FOR PERFORMING THE OPERATION WITH THE KNIFE OR WITH THE GORGET.

OF THE LATERAL LITHOTOMY INVENTED BY THE ENGLISH SURGEONS, AND NOW PRACTISED ALL OVER EUROPE.

It is gratifying to recollect that in our own country, England, there have not been wanting men, skilful in surgery and anatomy, who have improved this particular operation to the highest point, so that it is universally known among foreigners under the title of the Lateral Lithotomy, or Operation of the English surgeons. Of the science and skill of those English surgeons we have reason to be proud, and still more of their open, manly, and ingenuous manners; for, with the worst examples before them, they acted the most generous part, not only disclosing their operation, but teaching it most assiduously to strangers.

No sooner was the biography of Rau published by Albinus, than it excited universal satisfaction to find that an operation which was supposed to have died with its inventor, was so plainly described. This memoir found commentators in all countries; in England, the surgeons, especially of the great hospitals, St. Bartholomew's, and Guy's, took a most particular interest in it. Douglass was the historian of what was doing among our neighbours, and presented to the Royal Society a memoir, containing translations of this piece of Albinus, and he produced at the same time a system of dissections to support his reasoning. " As soon," says Douglass, " as the book of Albinus was published at Leyden, he did me the honour, amongst several of his ingenious friends here in London, to send it me in a present; and, at the next meeting of the Royal Society, I thought proper to lay before them an abstract, in English, of that part of it which relates to Mr. Rau's operation for the stone, together with several preparations, from which I demonstrated and described the parts concerned in it*. So natural is the desire of claiming inventions already announced to the public, that Douglass could not refrain from an attempt of this kind. "Of the several ways," says Douglass, "of getting into the human bladder, I always reckoned that practised by professor Rau to be one, long before I had heard any thing of his true method, or even of that of Frère Jaques;" and he adds, with exultation, that "by his early translation of Albinus, he had inspired the surgeons of England with the desire of rivalling the lithotomists of other countries *."

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* He goes on to say, " These preparations I have had a good many years by me; they make part of a complete collection that I have made, by which all the possible ways of getting into the human bladder, in order to extract the stone, may with the greatest clearness be illustrated; even the advantages and inconveniences of each of them, as far as they depend upon the structure of the parts, with the greatest certainty determined. Of these ways I always reckoned that practised by Professor Rau to be one long before I had heard any thing of his true method, or even of that of Frère Jaques."—Douglass, p. 81.

In the great hospitals of London, the high operation had hitherto been performed, when Bamber, in St. Bartholomew's, and Chesselden, in Guy's and St. Thomas's hospitals, adventured to perform this new operation, "each in the way that best suited his genius." Bamber servilely adhered to the text of Albinus; "he thought it proper to follow every step of Rau's method, except that he filled the bladder moderately with water †:" while Chesselden, with a bolder hand and more adventurous spirit, sought out a safer way of performing the incision.

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* "If I may judge by the event, what I then offered to the Royal Society was, by many members of that honourable body, thought no unsuitable entertainment for them; for, from that time, several worthy physicians and surgeons having carefully read Albinus's book, and examined my preparations, began to think seriously of introducing the practice of it among us. And I most willingly embrace this opportunity of doing justice to the ingenious Dr. Bamber, and Mr. Chesselden, by declaring, in a public manner, (what I had many opportunities of knowing, having assisted at most of the experiments they made on dead bodies,) that, as it was their turn to cut in the two great hospitals of this city the following season, I beheld with the utmost pleasure the alacrity, industry, and application with which they soon made themselves masters of this operation, each in the way that suited his genius best."—Douglass, page 82.

† Douglass.

It was believed, that if the incision was made into the body of the bladder, the neck and prostate being spared, no fistula could ensue; and it was rumoured that Rau knew how to perform this dissection, and that it was to this peculiar method he owed all his success. Chesselden had no information concerning Rau's method, but what tended to deceive him: he cut, according to this theory, deep into the body of the bladder, and his patients expired in great tortures: he was then conscious that the very form of incision which was designed to prevent fistulas, was actually the cause both of fistulas, and of still more imminent dangers; and then it was, that resolving to judge for himself, he invented that operation which has been named the Lateral Operation ever since. "Upon these disappointments," says Chesselden, "I contrived the manner of cutting which is now called the lateral way*."

In no long time the lateral operation of Chesselden became as famous as the operation of Rau or Frère Jaques. Morand, then the most celebrated surgeon in France, was struck with a great desire of visiting England; and he came to this country not as an individual zealous in his profession, and willing to receive the instructions of the first lithotomist in Europe, but as the accredited envoy of the Royal Academy of France. "Hearing," says Morand, "of the great success of this operation, I proposed to the Royal Academy of Sciences to take the journey, in order to witness the operations of this lithotomist; and so highly were the members pleased with my design, that it was agreed that I should travel at the public expense." The opportunities I had, in the year 1729, of seeing this operation in St. Thomas's hospital, the questions I put to the patients of Chesselden, and the conversations I had with the operator himself, gave me conceptions which speculation alone never could have enabled me to attain. I resolved, therefore, to attempt the operation, which, though I believed more difficult than that by the apparatus major, I found infinitely more easy."

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* Anatomy, page 330.

A surgeon of this country must read the encomiums of Morand with particular pleasure. "Chesselden," says he, "after having overcome, by an effort of his mind, and for the good of his fellow creatures, a natural repugnance to operations, performed this in particular with admirable coolness, and surprising rapidity; I have often seen him extract the stone in twenty-four seconds, and indeed he seldom took more than one minute in ordinary cases, where there was but a single stone. He cut, while I was in London, twenty-seven patients without losing one; the twenty-eighth died; but even before this man died he had cut thirty-one patients: he had in three years cut ninety patients with unparalleled success."

Morand returned to his own country, and all the surgeons of France were impatient to learn the result of his mission; among these Garengeot bore the suspense with the worst grace. He declaimed against Morand, Chesselden, and all the world; and as they declined instructing him in this new manner of operating, he took the privilege of saying that he had, by his natural ingenuity and diligent experiments, discovered the true operation himself. Douglass had affected to discover, unassisted, the operation of Frère Jaques; Garengeot, in like manner, affected to have anticipated (yet it was only by two days) the discovery of Chesselden's operation. "We hoped," says he, "to have our doubts resolved by M. Morand, and to learn from him, by example, to perform the operation of Chesselden; but the happiness of seeing him operate on the dead subject was reserved for a few, as discreet and silent as himself. We neglected not, in the mean time, to apply to some of our friends, who were intimate with Chesselden, for the needful information; but this celebrated surgeon only replied, that having concealed nothing from Morand, and having even explained his operation in writing, he could say nothing, neither to friends nor strangers, which might anticipate the memoir which M. Morand was preparing to present to the Academy."

Thus it would appear that Morand had regarded this *confrère* of his as a busy, meddling, restless creature, and treated his petulance with something like contempt; and that Chesselden had, on his part, acted with good faith to his friend Morand; but far from concealing an operation learned at so much expense, and so interesting to humanity, Morand made it public without loss of time, and gave the lie to Garengeot, by teaching it assiduously to all his pupils; and almost all the younger surgeons in the cities and provinces of France had been his pupils. He particularly taught Le Cat, and held the staff for him in his first operations, and he gives us a long list of the lithotomists who practised Chesselden's operation, and their various successes. Mr. Dent, the surgeon in Dublin, was of the number of those pupils, and had performed the operation upon twenty-three patients, of whom twenty-one survived. The list of operations performed in Rochfort, Besançon, Cadiz, Perpignan, Utrecht, Montpellier, Brussels, Bergen-op-Zoom, and other cities, proved that, of thirty or forty cut for the stone, no more than three or four died; at Bergen-op-Zoom, thirty were cut for the stone, of whom not one died*.

Thus was the lateral method, or the operation of the English surgeons, introduced into foreign countries, in a manner peculiarly honourable to the inventor; and abroad, as well as at home, the operation of Chesselden has been invariably preferred to all others, though it has been performed in a variety of ways. "In all the cities of France," says Morand, "the surgeons practise Chesselden's operation: some with a knife like Chesselden's, some with the lithotome caché of Frère Côme; some with one instrument, others with another: but all practise his method in preference to the old."—"But Chesselden, trusting entirely to his knowledge of the parts, cut simply with the knife and staff; and it is peculiarly interesting to observe the several changes of his operation, and the motives which induced him to change. That we may at once have under review all the various stages of improvement, I shall analyse, in distinct order, the several variations in the lateral operation, deducing it from the rude incision of Frère Jaques.

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* Garengeot says: "Il eut été à souhaiter pour y réussir, de pouvoir tirer quelque éclaircissement de M. Chesselden lui-même, ou de quelque personne entendue qui eut fait un récit de sa méthode, et l'eut exécutée sur quelques cadavres. Mais le mistère des uns et des autres est si grand, que jusqu'ici ni compatriotes ni étrangers n'en ont pu rien apprendre."

This paragraph is a gross and palpable falsehood, it is directly aimed at Chesselden and Morand; the one most liberally inclined and actually employed in teaching his operation, and practising it openly; the other industriously employed in learning, with the design of teaching it in France. Morand being the deputy of a public body, was in no shape amenable to Garengeot; and this paragraph was written in mere bitterness of spirit, when he found he had no opportunity of anticipating Morand. "This gentleman," says Morand, "has a singular passion for writing on every thing, and before every body."

First, Frère Jaques, rude and unskilled in anatomy, struck his knife into the hip, aimed at the body of the bladder, and generally reached the body of the bladder at that part which lies behind the prostate. He was dexterous only in extracting the stone: his operations were generally unsuccessful: the good he did the profession was, the proving that it was safe to cut, with the knife, those parts which hitherto they had ventured only to dilate with the instruments of the apparatus major.

Second, When Frère Jaques had been taught, by Fagon and Felix, to reform his operation; in place of striking his dagger-shaped knife thus all at once deep among the parts, he cut upon a grooved staff, made his outward incisions as we do, not by striking the knife like a poignard into the hip, but by successive longitudinal incisions, and made his inward incision by cutting the prostate gland and neck of the bladder upon the groove of the staff.

Thirdly, Rau, skilful in anatomy, dexterous in surgery, and diligent in remarking the operations of Frère Jaques, learned from him, when he first appeared in Amsterdam, this operation of cutting behind the gland; and then it was proclaimed as the true theory of lithotomy, that, by cutting in the body of the bladder and sparing the gland and the sphincter vesicæ, no fistula nor incontinence of urine could happen, since those important parts were left entire: to cut thus into the body of the bladder, behind the gland, was thought the most scientific and the most certainly successful incision.

Fourthly, Rau * could not long mistake the principles of the operation; he must soon have discovered that an incision, thus deep among the cellular substance surrounding the rectum, an incision so oblique in which the external was so ill opposed to the internal wound, could not prevent fistulas, but must rather cause them; he accordingly discovered, by his own natural ingenuity, the danger of cutting into the body of the bladder; and by seeing Frère Jaques, upon his return to Holland, perform his new and more scientific operation taught him by Fagon, he was confirmed in his reasonings: then his splendid successes began; for then he cut, like Frère Jaques, the prostate gland and neck of the bladder, upon a grooved staff; but he put still his finger on his lips, and when questioned by his pupils about the precise place and effect of this incision, he refused to answer, or only replied, "Legite Celsum." He thought his reputation at stake, and, though it was manifestly important

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* The celebrated lithotomist Rau carried the secret of his operation with him to the grave; he operated, during his life on 3000 patients; his operations in hospitals and in the private chambers of the sick were witnessed by hundreds and thousands. The surgeons, the physicians, the pupils, who were present at the public operations of Rau, and the strangers who came from all countries to see him, were anxious to learn how he operated, but in vain! he foiled them in all their more subtile attempts, to discover what parts he cut, and to their direct inquiries his only answer was "legite Celsum." So little can the man who only sees the outside flourishes of an operator, know what he is doing with his knife or finger among the parts.

to the profession and to humanity, that he should make known his true operation, he was so disingenuous as to leave the world under the continued impression that the wound he made was still in the body of the bladder! His secret went with him to the grave.

Fifthly, When Chesselden, dissatisfied with the high operation which had hitherto been performed in the London hospitals, resolved to imitate the operations of Frère Jaques and Rau, he had no guide but the descriptions of Albinus, who, though long the assistant of Rau, was himself deceived. The general persuasion was, that Rau had cut into the body of the bladder, behind the gland; and that his leaving the prostate gland, the neck of the bladder, and the sphincter entire, was the cause of his success. An anatomist so skilful and enterprising as Chesselden could find no difficulty in making this deep incision, holding down the gut with his finger, and dissecting till he came to the body of the bladder; he practised this method for a little while, but, in place of the splendid successes of Rau, he found nothing but disappointment, four patients, out of ten, died, and in the most miserable manner. This was his operation in the year 1726*.

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* Douglass, the first who reviewed the biographical sketch by Albinus; the first who translated and commented upon it; the first who directed the attention of the English surgeons to the operation of Rau; the first who made systematic dissections of the parts, was eager to claim these honours; he laid claim even to the discovery of Rau. Douglass, while he was busy with these dissections and translations, was in haste to explain the operation of Chesselden before he understood it, and to claim peculiar honours for that operator, before his operation differed in the slightest degree from the first and worst method of Frère Jaques. Douglass's history of Ches-

Sixthly, Sensible that the sufferings and death of his patients proceeded from these deep incisions, Chesselden trusted no longer to the reports concerning Rau's operation, but to his own genius, and ap-

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selden's operations in the year 1726 is this: "I have already mentioned an account of Rau's method given by Mr. Chesselden, in the 'Preface to his Treatise on the High Operation for the Stone,' published 1723, as he had received it from those who had been scholars to Mr. Rau, and several times present at his operations. His informations were indeed very lame and imperfect, but yet, even from these he had conceived so favourable an idea of that method, as to think it preferable either to that of Celsus or Marianus; and withal that it would be still more so, if the bladder was first filled with water."

"Albinus's late Treatise has, as I have already remarked, given this ingenious and most expert surgeon an opportunity of examining the whole matter with more clearness and certainty than he had done before; and the fruit of the pains he has been at, is not only to confirm him in his former favourable opinion of it, but also to bring it to such a degree of perfection, as in his judgment makes it preferable to all the methods of cutting that have ever been invented."

"The patient being brought from his bed in a night gown, and situated in this manner, the operator thrust a hollow grooved steel catheter through the urethra into the bladder, and with a syringe, mounted with an ox's ureter, injects as much warm water into it as the patient can bear without pain, in the same manner as is done in the high operation. Into one patient of about eighteen years of age, and who had a stone weighing six ounces and a quarter, Mr. Chesselden injected seven ounces of water; but he thinks the quantity may always be determined by the complaints of the patient, without observing any other rule."

"When the water is injected, and secured from running out, by tying round the penis a narrow slip of flannel, he gives the end of the catheter to an intelligent assistant to hold, whose principal care is to keep it from rising, but not at all to direct the groove to the place where the incision is to be made, for a reason that we shall hear presently."

"Then the operator, having seated himself upon a chair, the height of which is suitable to that of the table on which the patient is laid, takes a pointed knife with a convex edge, and beginning about an inch above the anus on the left side of the rapha, between the accelerator urinæ, or, as I name that muscle, constrictor urethræ, and the erector penis, he makes an incision downwards, by the side of the sphincter ani, a little obliquely outwards, as it descends from two and a half to four inches in length, according to the age of the pealed from the authority of Albinus to the anatomy of the parts. He resolved to cut no more by the side of the rectum so deep, but to cut, in place of the body of the bladder, the neck only, and the prostate gland which surrounds it: The several ways in which he at various times performed this operation, the true lateral lithotomy, are extremely interesting.

First, after having forsaken the operation of Rau, when he first adventured on that operation (the slitting up the side of the prostate gland), which was afterwards called the lateral method, he, after a free external incision, in which he cut betwixt the accelerator and erector muscles, introduced two fingers to feel for the staff, and hold down the gut; and, seeking out the membranous part of the urethra, he cut up that part of it and the side of the prostate*.

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patient or size and structure of the parts. This first incision he endeavours to make all at one stroke, so as to cut through the skin, fat and all, or part of the levator-ani, which lies in his way."

"As soon as this is done, he thrusts the forefinger of his left hand into the middle of the wound, in order to press the intestinum rectum to one side, that it may be in less danger of being cut, and, taking a crooked knife in his other hand, with the edge on the concave side, he thrusts the point of it through the wound, close by his finger, into the bladder, between the vesicula seminalis and os ischium of the same side; then, lowering his hand, he continues this second incision upwards till the point of his knife comes out at the upper part of the first."

"This is Mr. Chesselden's regular method of cutting, and when no accident happens, which it was impossible to be aware of before the operation, he has been seldom above a minute (sometimes less) between the beginning of the first incision and extraction of the stone."—Douglass on Lithotomy.

At this time then it would appear that Chesselden had not yet invented the lateral operation, and was but occupied in imitating the operation of Rau, with no other difference than that of distending the bladder with tepid water.

* "This operation I do in the following manner: I tie the

This was the operation described by Chesselden in the Appendix to his Anatomy; the operation which he taught to Morand, who merely translates the words of Chesselden: "Je continue de couper de haut en bas entre les muscles accelerateur de l'urine et l'erecteur de la verge, et à coté de l'intestine rectum. Je tâte ensuite pour trouver le sonde, et je coupe la dessus le long de la gland prostate, continuant jusqu'à la vessie, en assujetissant le rectum en bas pendant tout le tems de l'opération avec une ou deux doigts de la maine gauche*." Whatever the private instructions were which Morand received from the English lithotomists, they could not be such as to alter the design of the operation, which plainly consisted, according to the express words both of the master and of the pupil, in running the knife downwards and backwards through the thick substance of the prostate gland along the groove of the staff. It is very remarkable, that, having taught Morand this operation, Chesselden commends it to his particular protection, saying (in one of his private letters, after Morand's return to his native country), "that operation which I taught you, I am sure I never shall have reason to change;" and yet this favoured operation he did

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patient, as for the great apparatus, but lay him upon a blanket several times double, upon a horizontal table three feet high, with his head only raised; I first make as long an incision as I can, beginning near the place where the old operation ends, and cutting down between the musculous accelerator urinæ, and erector penis, and by the side of the intestinum rectum. I then feel for the staff, holding the gut all the while with one or two fingers of the left hand, and cut upon it in that part of the urethra which lies beyond the corpora cavernosa urethræ, and in the prostate gland, cutting from below upwards to avoid the gut."—Chesselden's Anatomy. Appendix on cutting for the stone, anno 1730.

[*] Morand, page 116.

change, and that in the next season for cutting for the stone! It was in the year 1731, the very year after Morand's return to France, that Chesselden forsook his first and approved operation, because all his care in keeping the rectum out of the way of the knife was of no avail; he ingenuously confessed to Morand, that, in running the knife backwards along the groove of the staff, he had twice wounded the rectum; there is reason to believe that, while he felt the difficulty of making this incision safely, he was conscious that the incision of the gland was often too small for the free transmission of the stone.

Secondly, Chesselden, reduced to the necessity of abandoning, not the principles of the operation, but the manner in which it was performed, continued to cut the same parts, viz. the membranous part of the urethra, and the prostate gland; but he cut them by moving his knife in a direction opposite to that of his first incision, *i. e.* from behind, forwards; his incision ending now, where, in his former operations, it had begun. The proofs of this mode of incision are also interesting, and I shall deliver them. It is in a second history of the operation by Douglass, dated Covent Garden, 1731, that we find the true operation of Chesselden described*. He had felt the difficulty of making a sufficient incision of the prostate; he had experienced the dangers of wounding the rectum in cutting from the membranous part of the urethra backwards to the body of the bladder; and he resolved now to dissect till he reached the body of the bladder and felt the staff behind the gland, and to open the whole length of the gland, by drawing the knife towards him along the groove of the staff.

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* Douglass, in his introduction to the History of the New Operation of Chesselden, says, "Since the time of my first publication, viz. that in 1726, Mr. Chesselden has, for very good reasons, laid this method aside and substituted another very different in its room, which he now practises with great applause and vast success, having saved fifty patients out of fifty-two."

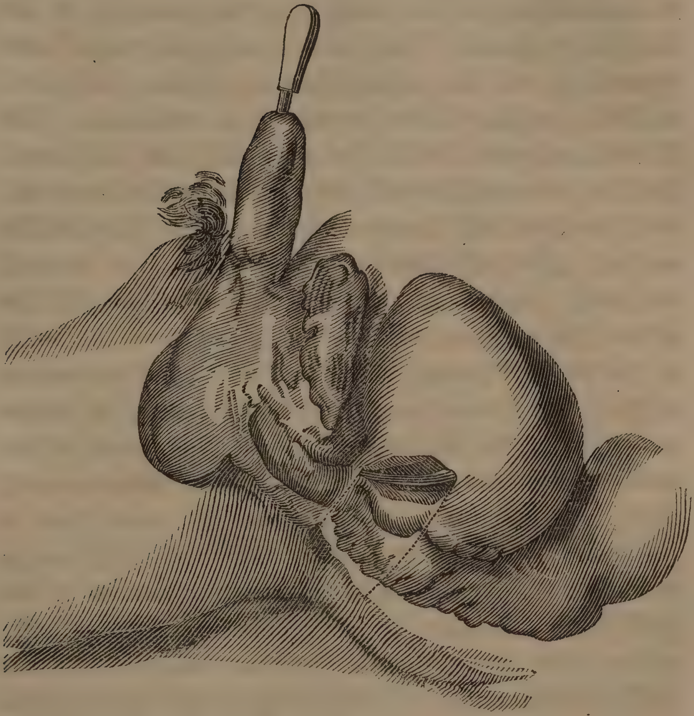
"In performing the lateral operation, he makes the first or outward incision," says Douglass, "through the integuments, from above downwards, beginning on the left side of the raphe or seam betwixt the scrotum, and the verge of the anus, almost as high up as where the skin of the perinæum begins to dilate and form the bag that contains the testicles, and from thence he continues the wound obliquely outwards, as low down as the middle of the margin of the anus, at about half an inch distant from it, near the skin, and consequently beyond the great protuberance of the os ischium.

"The first, or upper part of this incision is cut superficial; after that, he plunges his knife much deeper by the side of the rectum, and finishes it by drawing his knife obliquely towards himself. These three motions may always be observed in his external incision, but the last is performed pretty much at random; his knife first enters the groove of the rostrated or straight part of the catheter, through the side of the bladder immediately above the prostate; and afterwards, the point of it continuing to run in the same groove in a direction downwards and forwards, or towards himself, he divides that part of the sphincter of the bladder that lies upon the gland; and then he cuts the outside of one half of it obliquely, according to the direction of the whole length of the urethra that runs within it, and finishes his internal incision by dividing the muscular portion of the urethra on the convex part of the staff.

"When he first began to practise this method he cut the very same parts the contrary way, that is, his knife first entered the muscular part of the urethra, which he divided laterally from the pendulous part of its bulb, to the apex of the prostate gland; and from thence directed his knife upwards and backwards, all the way into the bladder, as we may read in the appendix he lately published to the fourth edition of his book of Anatomy. But some time afterwards he observed that in that manner of cutting, the bulb of the urethra lay too much in the way, the groove of the staff was not so easily found, and the intestinum rectum was in more danger of being wounded."—Douglass.

Chesselden, with all the enthusiasm of an inventor, believed that he had discovered an operation which was not susceptible of improvement; yet he himself changed the form or manner of his incision no less than three times in the course of a few years. First, He cut into the body of the bladder behind the prostate, when he imitated Rau. Secondly, He cut another part of the bladder, viz. the neck and the thick substance of the prostate; this is his lateral mode of incision. Thirdly, He changed a third time, not the essential form of the incision, but the direction in which he moved the knife; for in his first operation, when imitating the supposed operation of Rau and Frère Jaques, he struck his knife into the body of the bladder, betwixt the tuber ischii and the vesiculæ seminales, and all his incision lay behind the prostate gland: in his second operation he struck his knife into the membranous part of the urethra, immediately behind the bulb, and ran it down through the substance of the gland; but his incision stopped at the membranous part or body of the bladder: but in his third operation, he, after very large external incisions, struck his knife deep into the great hollow under the tuber ischii, entered it into the body of the bladder immediately behind the gland, and, drawing the knife towards him, cut through the whole substance of the gland, and even a part of the urethra, "cutting the same parts the contrary way." By carrying the forefinger of the left hand before the knife in dissecting towards the body of the bladder, he protected the rectum more perfectly than he could do in running the knife backwards along the groove of the staff; and, by striking his knife into the body of the bladder, and drawing it towards him through the whole thickness of the gland, he was sure to make an ample wound.

But when he learned thus to plunge his knife thus deep into the hollow under the tuber ischii, and push it into the body of the bladder behind the prostate gland, and to make his internal incision by drawing the knife towards himself, one would imagine he were performing the very operation with the success of which he had been so ill satisfied! By no means! The first and the last of his operations were essentially different; in his first operation he struck the knife, in imitation of Frère Jaques and Rau, into the bladder, betwixt the vesiculæ seminales and tuber ischii: he stopped at the back part of the gland; all his incision lay behind the gland; he cut the body of the bladder only: but in his last operation, which all succeeding lithotomists have approved and practised, he cut no part of the body of the bladder; he entered his knife close behind the prostate gland, and, in drawing it towards him, he of course cut only the neck of the bladder where it is surrounded by the gland *.



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* That this was the operation performed by Chesselden, I have already sufficiently proved;—that this operation was understood universally in other countries, my reader will be easily satisfied by the following quotation: "Demittitur autem scalpellum in vulneris angulum inferiorem, quò post prostatam vesicam primum intret. Hinc etenim incipiendo, plagam vesicæ tam versus bulbam urethræ

And here let me once for all remark the difference betwixt the lithotomy of the French and of the English surgeons; for, while "they cut the same parts, they cut them (to use once more the words of Douglass) the opposite way." The French cut, in imitation of Frère Jaques and Rau, from before, backwards; and differ in every circumstance, in the posture of the patient, in the form of the knife, and in the holding of the staff, from the method of the English surgeons. The French surgeon kneels when operating, and his patient lies not horizontally, but reclining against the breast of an assistant. The French surgeon holds the staff with the left hand, lest the assistant should displace it in the most critical moment of the operation; and in place of dissecting gradually forwards, he, after the outward incision, plunges his knife into the hollow by the side of the rectum, and runs the point of the knife at the bent of the staff. In place of using the common scalpel, the French surgeons have used a lithotome or knife, better accommodated to this mode of incision; it is conical, pointed, equally sharp on both sides, and resembles an abscess-lancet, made fast in its scales. The French operated in the following manner: The surgeon, holding the handle of the staff in his left hand, used to feel with the forefinger of the right for the bending of the staff, where it lies in the perinæum, the knife being in the mean while

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ampliat; dissectis, hoc opere, sinistrâ portione glandulæ prostatæ, colo vesicæ, et parte urethræ membranaceâ." Kesselrig de Method. Foubertianâ.—This is the description of a gentleman who had been in London, and who had seen the lateral operation five times performed by Mr. Ghirle at St. Thomas's hospital, Chesselden himself being present.

held in the mouth; then, taking the lithotome in the right hand, he made the outward incision with the edge of the knife, drawing the knife along like a common scalpel; then, plunging the point into that part of the hollow where he had marked the catheter, he ran the point of the knife, as soon as it had encountered the naked part of the staff, (viz. just behind the bulb), onwards into the bladder, through the body of the prostate gland. Such an incision as shall by-and-by be explained, while it made too small an opening in the gland, could not be accomplished without great danger to the rectum, for this especial reason, that the left hand of the operator, in place of being employed in guiding the inward incisions and in pressing the rectum out of the way of danger, was occupied in holding the staff*.

"The English surgeon usually sits at his operation; (but in this, I am a French Catholic, and would rather kneel †;) his patient lies quite horizontally, or even has his breech raised by a pillow, which better exposes the perinæum and hip." Having once placed the staff and felt for it in the perinæum, he delivers it to the assistant surgeon, who, by holding it, gives the lithotomist the use of both his hands. He cuts with the common scalpel, because his purpose is, after the outward incision, to dissect onwards through the cellular substance surrounding the rectum and bladder. After the great outward incision, which goes through the skin and cellular substance, he dissects, by successive strokes, into the hollow under the tuber ischii; presses the rectum out of the way of danger, with the fore and mid fingers of the left hand; and with the forefinger, particularly, he judges of what he is dissecting, feels for the prostate, and dissects till he can distinguish the staff behind the gland, through the thin walls of the bladder: he then, in place of endangering the rectum, turns the edge of the scalpel upwards away from the rectum, directs its edge fairly to the prostate gland, and cuts the whole length of it upon the groove of the staff. The French used a pointed knife, because they performed the last and most critical part of the incision by a sort of plunge, running the lithotome backwards into the bladder! The English use a common scalpel, and, in the most critical part of the operation, turn the back of the knife to the rectum, and the edge to the prostate, which they divide by drawing the knife towards them along the groove of the staff.

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* "However, it must be confessed that this kind of knife seems best calculated for their manner of cutting, because, instead of making three or four different incisions down to the neck of the bladder, as we practise in England, they first divide the skin, and then continue to push the knife forwards without once withdrawing it till the incision is finished." Sharp, page 220.

† Chesselden, or his pupil Sharp, who records these little peculiarities of the French and English operations, does not remark the cause of the difference of posture, which is plainly this; that the posture of the surgeon must be regulated by that of his patient; the eye must always be under the place of incision; if the patient lie inclined with his shoulders raised, as in France, the surgeon must kneel; if the patient be laid horizontally with his breech a little raised, as is the practice in England, the surgeon may sit; but in either case I think it better to kneel.

The cutting of the prostate, then, is the essential part of the inward incision; the more completely the gland is divided, the more easy is the extraction of the stone; and as for the future consequences of such incision, or the healing of the wound, the superiority of this mode of operating must be decided by comparing the form of the incision with the anatomy of the parts.—This comparison of the forms of the incision with the parts to be divided is the last step of that analytical process by which I endeavour to instruct my reader, and to enable him to make his election: the superiority of this operation will, I believe, be easily proved by very simple plans.

ANATOMICAL ANALYSIS OF THE OPERATIONS OF FRERE JAQUES, OF RAU, AND OF CHESSELDEN, BY WHOM THE LATERAL INCISION WAS INVENTED AND PERFECTED.

I have avowed it as my opinion, that, of all the operations of surgery, lithotomy is that in which the true principles of the operation may be most safely deduced from the anatomy of the parts. To conjecture, *à priori*, which form of incision would be attended with fewest dangers, would not be difficult; but now that we have before us such a suite of experiments, performed in various countries by the greatest masters in surgery, and accompanied with such authentic records of their various successes, we are able, from experience as well as theory, to resolve that important problem, "How we may, with least danger, open our way into the bladder, for the extraction of the stone."

First, There is no possibility of making a wound sufficiently large for the exit of the stone, but by opening the great hollow by the side of the tuber ischii, by cutting across the transverse muscles, dissecting deep among the cellular substance, and going right forward betwixt the rectum and the tuber ischii, till we reach the bladder; in short, there is no way of making a sufficient opening for the exit of the stone, but by cutting upon the hip: and I beg that my reader will carefully distinguish this from cutting upon the perinæum, as in the old operation of Marianus.

Secondly, This hollow, where we seek for the bladder and prostate gland, is filled with the loosest cellular substance, uniting the most membranous parts, viz. the coats of the bladder and rectum; and there is unfortunately so great a distance betwixt that part of the bladder which we aim at and the external wound, that, cut how we will, the course of our wound must be more or less oblique, and an oblique wound among membranous and cellular parts is never void of danger.

Thirdly, When we aim at the body of the bladder behind the gland, we dissect deep by the side of the rectum, and make a wound peculiarly oblique and unfavourable, from which the most melancholy symptoms ensue. Chesselden, for example, when he designed to imitate the supposed operation of Rau, pressed the bladder low down with the staff, and, having made his external incisions, he struck a long and crooked bistoury into the body of the bladder, behind the gland. The wound being large and free, the extraction of the stone was not difficult: the patient slumbered out the two first days in perfect tranquillity and apparent safety; but the cellular substance, in this long oblique wound, being infiltrated with urine, the parts never healed but suppurated, wasted, became fistulous, while sometimes the peritoneum also partook of the inflammation, the abdomen was affected, and the patient expired in torments.

Fourthly, When, in place of aiming at this deep-lying part of the bladder, we aim only at the prostate; when we open, by incision, the gland itself and the neck of the bladder, which the gland surrounds, we make the most favourable wound; then, in place of an oblique and deep incision, in which the external opening is at the greatest possible distance from that in the bladder, we have an incision comparatively superficial, in which the internal is nearly opposite to the external wound. In place of cutting into the thinnest and most membranous part of the bladder, surrounded only by the loose cellular substance, our incision passes through the thick and firm body of the prostate gland, which, as it surrounds the cut part of the cervix, closes the incision by its swelling, puts the wounded surfaces in mutual contact, and affords, by its fleshiness, a substantial granulation for the healing of the wound. This swelling of the gland, which ultimately conduces so much to the cure, often closes the neck of the bladder so suddenly, that the patient begins to pass his urine by the penis, even on the second or third day after the operation*.

These general principles are admirably illustrated by the experiments and actual successes of Chesselden, Rau, and Frère Jaques.

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* I must again declare this circumstance to endanger extravasation of urine into the cellular membrane, and that we should provide against it by keeping the wound free. See concluding note.

OF THE VARIOUS WAYS OF PERFORMING THE LATERAL OPERATION, WITH THE TROCAR OF FOUBERT, THE KNIVES AND KISTOTOMES OF LE CAT, THE BISTOURI CACHEE OF FRERE COSME, AND THE CUTTING GORGET OF SIR CÆSAR HAWKINS.

I have just reviewed the lives of those eminent lithotomists from whose disappointments, errors, and final improvements, I hope to draw the most useful lessons: But, as skill in anatomy led to those bold operations which were performed during last century with such memorable success, ignorance of anatomy has been the occasion of surgeons, in latter times, seeking to avoid this curious, and, as they believe, dangerous dissection with the knife, and of substituting in its place probe-pointed or beaked knives, which are conducted, by the help of grooved staffs, through the neck of the bladder and prostate gland.

Have we not reason to fear that our science is on its decline, when, in place of cutting into the bladder boldly, the knife being guided by a knowledge of the parts, surgeons are willing to conduct their knife merely by running it along a grooved staff? That such a change implies a decline of science, and want of anatomical skill, is what I might perhaps be able to prove; but sure I am, that I can demonstrate dangers attending this blindfold stroke of the gorget more truly terrible, to a well instructed surgeon, than any accidental deviations of the knife: we cannot but remember how very much the reputation and actual performances of Chesselden and Rau have excelled the puny conceits and short-lived fame of Le Cat, Frère Cosme, Hawkins, and other modern inventors. We cannot but lament, that the operation by which a surgeon can insure success proportioned to his skill and knowledge, has fallen into disuse; while a rival operation, a blindfold stroke, the dangers of which are acknowledged even by those who perform it, usurps its place, for no avowed reason but that it can be as successfully performed by the ignorant as by the skilful! Such mechanical contrivances would, indeed, be of inestimable value, were it possible in surgery, as in manufactures, to transfer the skill from the inventor to the operator, and to reduce the class of working men from scientific operators to mere mechanics,—to men performing things which they do not comprehend, and contented with success which they do not deserve. Thus the carver, or caster in bronze, shapes a leaf with a single stroke of a tool, which he never invented, or turns out from a die a bas-relief, which he has not even the sentiment to admire, much less to model! by such inventions have all the arts which are merely mechanical been facilitated and improved; but such a process is too simple by far for the improvement of a science which, in every particular act, requires intelligence and design.

The following question, though of infinite importance to society, far from being resolved, has not even been proposed:—" Is it safer to perform the operation of lithotomy with instruments so curiously adapted to each other by buttons and grooves, that the groove of the staff may conduct the knife into the bladder without any nice regard to the size or conformation of the parts, just as a common directory guides a bistoury?—or is it safer to study the anatomy of the parts, to learn to dissect them deliberately, and to cut the prostate gland, not by a sudden and blindfold push of the gorget or cutting director, but with the knife guided by the finger?" This question will be easily resolved, by reviewing the inventions of Le Cat, Frère Cosme, Foubert, and Hawkins; these were the first who deviated from the simple dissection of Rau and Chesselden; they were the first inventors of grooved lithotomes, concealed knives, and cutting directors: their complicated and unhandy instruments exhibit a singular contrast with the simple operations of Chesselden and Rau, and their achievements form a curious and instructive episode in the general history of lithotomy.

I am now entering upon a department of this subject peculiarly delicate, where, if I have an opinion different from that of the profession, or think myself arrived at those years of experience and knowledge, at the period of professional reputation, which may enable me to form an opinion or entitle me to express it freely, it becomes my peculiar duty to do so, however unfavourable that opinion may be to the operation now in common use. But whatever doubts I have concerning the superiority of the modern operation, shall be simply and honestly explained; nor will I allow myself to suppose that I can suffer the slightest blame for being true to my profession, and discussing, with manly freedom, those questions which are of universal concern, if only I discuss them, as I protest I do, without ungenerous allusions either to real misfortunes or to rumours of ill success, without partiality or favour, or fear, or hatred of the living or the dead. Happily it is in my power to illustrate every axiom by reference to the schemes and practices of those who are no longer sensible to praise or censure.

OF THE OPERATION OF M. LE CAT.

M. Le Cat, a surgeon of Rouen, in Normandy, is the gentleman whose orthodox faith, and sound ingenious comments on the aphorisms of Hippocrates, have been already celebrated; he was the first who formally and deliberately vindicated the principle of dilating the neck of the bladder with instruments, according to the analogy of the natural dilatation of the womb. He showed still greater ingenuity when he changed from his original practice of dilating the neck of the bladder, to the new operation of cutting the prostate gland, without any apparent breach of principle, merely by the invention of a new term, by naming his incision of the prostate "Le debridement du col de la vessie." When, at last, he was driven from such evasions, and forced to perform, along with all the profession, the lateral incision of the prostate, he operated with an apparatus so complicated, that to describe his operation were very difficult, to perform it impossible; his restless genius for invention had suggested to him so many improvements, that he knew not himself, at any one period, with which of his knives he was operating *; his bag of instruments

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* "J'operai avec les trois espèces de mes instrumens, le cistitome à tranchant discontinu, celui à tranchant continu, et le gorgeret-cistotome. Tous les resultats furent exactement les memes."

resembled the confusion of a lecturer's table, where specimens of the idle inventions of various æras are tumbled in one heap: in all his theories and plans of operations, and in the grotesque shapes of his knives and conductors, there was an affectation of singularity, or rather a manifest depravity of judgment. When the simple operations of Rau and Chesselden were publicly promulgated, Le Cat, if he had been possessed of good sense or sound judgment, should have been disgusted with the puerile occupations of his former life! he should have thrown aside his complicated instruments, and applied himself, as he was an excellent anatomist, to learn the simple and manly operation of Chesselden with the knife and staff! but it is a curious anecdote in surgery, it is mentioned with astonishment by Morand, and even by Le Cat himself it is acknowledged, that when Morand, just returned from England, taught him the operation, he would not perform it! For this he had not the apology of Garengeot, "Le mysterieuse des etrangers et compatriotes." Morand put the small lithotome or incision-knife of Chesselden into the hands of Le Cat, and held the staff for him, and made him perform the operation, but he rejected the knife with the waywardness of a child, he sought trivial apologies for not using it, and affected to prove that it was not fit for performing the incision of the prostate*.

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* "Il est vrai que le petit couteau de M. Chesselden que mon célèbre et respectable maitre M. Morand m'a mis à la main pour faire l'incision extérieure et intérieure tout de suite, est plus simple que mon uréthrotome et mon cistitome que j'y a substitue. Mais, 1°. Ce simple instrument fait avec peine l'incision exterieure, et il

What was the issue of such perverse conduct? Le Cat's talents were lost to himself and to the public; he never became a distinguished operator; it was his fate to continue through life, writing volumes full of ingenious theories, the pages of which were never soiled by any finger, and to invent instruments still more ingenious than his theories, which were never sharpened for any hand, but his own: even in France, where every novelty has its admirers, Le Cat found no one to praise or follow him.

From the sketches I have given of his instruments, my reader will perceive how complex his operation was. One of them, I mean the thing resembling a gorget, was in itself a whole armoury. By raising a concealed knife, it made an opening into the bladder; by thrusting forward the canula or sheath of the knife, it dilated the wound it had made; and when thus lodged in the bladder, it became a conductor for the forceps: this he intitles, with no small degree of self approbation, his "Gorgeret Cystotome Dilatoire Composé," a title which marks the genius of all his inventions.

Le Cat must indeed have had a subtile head, even to remember the several steps of his own operation, which was performed somewhat after the following manner:—First, he introduced his long big staff, held, like that of Chesselden, by the assistant surgeon,

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fait trop petite, dans l'adulte, l'incision des prostates, ce qui l'a fait abandonner par M. Chesselden même. 2°. Ce petit couteau ne coupe que d'un côté, et si l'on y retourne, a deux ou trois fois pour inciser l'urethre on est obligé de le sortir autant de fois de la cannelure."

and he cut forward with a common scalpel through the skin and fat, till he could distinguish the bulb, the naked urethra, and the prostate gland. Secondly, with his knife called Urethrotome, having a groove on one side, he opened the urethra just before the prostate, and fixing the urethrotome in the groove of the staff, and holding it steady, rose from the kneeling posture in which he performed the outward incision. Thirdly, holding the urethrotome in the left hand, he passes another knife, the cistotome, along the groove of the urethrotome; and, the beak of the cistotome being lodged in the groove of the urethrotome, it was pushed forwards through the substance of the prostate gland into the bladder. Fourthly, drawing the cistotome a little backwards, he gave the staff to an assistant to hold it steady, and, lifting a blunt gorget in the right hand, he laid the beak of it in the groove of the cistotome, and ran it onwards till it glided from the groove of the cistotome along the groove of the staff, and was by the staff conducted into the bladder! then, true to the principles of the apparatus major, and never forgetting his own peculiar theory, that there should be "little incision and much dilatation," he bored in his finger along the gorget, dilated the neck of the bladder, and so prepared the way for his forceps.

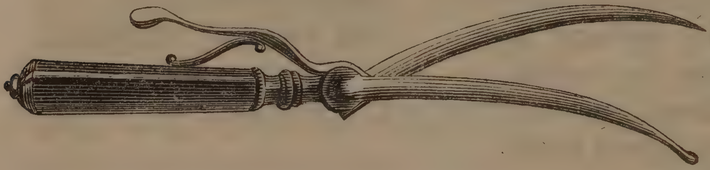
This complex operation I regard as the most remarkable and guilty deviation from the dictates of common sense, and from the sound principles of surgery; as the first attempt to substitute mechanical ingenuity for real professional talents and skill. If the point had been to contrive an operation in mockery of both the old and the modern surgery, of the apparatus major, with its number of instruments, and of the lateral operation performed imperfectly by timid operators, with small and trivial incisions, this would have been the very thing required! It is equally a burlesque of both methods, for the apparatus is too complex to be correctly used; the incision, when made, is too small to admit, without dilatation, even the introduction of the forceps, much less the extraction of the stone; and this incision, small and ineffectual as it was, Le Cat performed by an unguided plunge of a cutting instrument, which, in such a succession of grooves, must have been apt to slip. Yet this operation, with all its seeming peculiarities, was essentially the incision of Chesselden, accomplished in that very way which Chesselden himself, with all his skill and practice, found peculiarly dangerous, viz. by running the knife backwards through the gland, with imminent risk of wounding the rectum and pudic artery.

OF THE OPERATION OF FRERE COSME,

A Priest of an Order consecrated to the Charitable Duties of attending in the Hospital; ignorant, like Frère Jaques, of Anatomy, or the Principles of our Science.

If we are to substitute mechanical inventions to real skill, let those inventions be simple and plain, as Frère Cosme's was, who cut for the stone by performing the usual outward incisions, seeking out the membranous part of the urethra, opening it, and introducing a concealed bistoury, which was drawn out with the blade so raised as to cut through the prostate and make an opening in the cervix vesicæ, proportioned to the angle at which the knife was raised from its sheath.

While Le Cat was in the full ferment of his inventive faculties, and thought he had discovered instruments which admitted of no competition, this Frère Cosme, an obscure and uneducated man, communicated to the Journal des Sçavans de Verdun a short letter, announcing his invention of a bistouri-cachée, with which he imagined he could perform the incisions for lithotomy without the slightest danger.



This invasion of what Le Cat claimed as his peculiar province, displeased him, and he wrote an answer full of invective and passion, proclaiming the superiority of his own lithotome, and protesting that it was as much a bistouri-cachée as Frère Cosme's. Letter followed letter, till the replies and rejoinders amounted to a volume, full of sound and fury, signifying nothing. The letters I have read, or tried to read, and never do I remember to have seen the delirium of polemical fury work up to such a ferment, the combatants repeating, like drunken men, the same insignificant things, without consciousness or meaning. Nothing can be imagined more trivial than any one letter, or more tedious than the whole. Frère Cosme, though he wrote many letters, never signed his name; during all the heat and fury of the contest, he was known by no other style than the anonyme; ignorant as he was, he attained (even before his name was made known) to some importance by this dispute; had he been left alone, he and his bistoury would never have been heard of, but he had the good fortune to jostle in the dark against Le Cat, to whose vindictive, surly, and insulting replies, to whose reputation and talents for polemical writing, Frère Cosme owed whatever degree of reputation he acquired.

Le Cat, having by his infuriated conduct raised up a rival, and by his rudeness procured him friends, came to be engaged in a dispute not to be decided but by an appeal to the lithotomists and surgeons of the capital; they held a conclave on this question, in which Martiniere, first surgeon to the king, presided; the king himself condescended to take an interest in the debate, and received daily reports of the experiments made in hospitals upon dead bodies; M. Louis was general secretary of the conclave, while each member also kept his own private record of the facts. Le Dran, Morand, Foubert, Moreau, all the good surgeons of Paris were present; Le Cat was present in person, to perform his own operation; Frère Cosme was invited, but would not come, wherefore De Bastide, with others of his zealous pupils and friends, were invited in his place. The course of experiments began in the Hospital of Invalids, on the 23d February 1755, and was continued down to the 14th of March. The bodies were alternately taken in the theatres of the five principal hospitals, the Hospital of the Invalids, La Charité, L'Hôtel Dieu, Salpetrière, and Bicêtre. There were ten sittings of this committee, and the operation was performed in all fifty-one times. When the question was thus brought to the decision of the knife, Le Cat performed his own operations, while M. Bastide represented Frère Cosme: mutual accusations of irregular and dangerous wounds were not spared, and the debate became more furious, now that the number of the combatants was increased, and the anatomists, with their quotas of retainers, were fairly listed in the field. The battle, at last, grew so loud and furious as to be no longer safe nor reputable, and a sudden period was put to this unmannerly scene, without coming to that decision which Le Cat expected and claimed.

This was to Le Cat a most cruel disappointment; after a turbulent life, embittered by perpetual warfare, all his brilliant expectations ended in utter disappointment. His innumerable improvements had so accumulated, that his method of lithotomy was such as no one would be at the trouble of learning, or the hazard of performing. The value of the plain and simple incisions of Chesselden, now practised in France by Morand, came to be universally acknowledged, and the imperfect lateral incision of Le Cat was neglected. The disputes of Le Cat with Frère Cosme had excited so much of the spirit of intrigue, that the lithotomists were afraid to decide; and so powerful were the parties engaged in the dispute, that the very mention of his proposed innovation was excluded from the Memoirs of the Academy of Surgery. Even the name of Le Cat was not mentioned in the volume of that year, while the encomiums bestowed by Louis on Frère Cosme are as extravagant and hyperbolical tropes as ever issued from the mouth of a Frenchman *; such as should have been offensive to any man of correct taste, such as must have been very galling to Le Cat.

Yet Frère Cosme's was an operation infinitely more dangerous, a stroke of the knife less under the guidance of the surgeon than that of Le Cat. There needs no suite of experiments to prove those dangers, which any one acquainted with the anatomy of those parts might confidently foretel. The opening made in the membranous part of the urethra admits the bistoury to the groove of the staff; by the direction of that groove it is passed into the bladder; when lodged in the cavity of the bladder, the staff is withdrawn, and the bistoury lateralized, or, in other terms, turned with its edge towards the sides of the bladder and prostate: all this part of the operation is sure and safe; but the moment the blade is raised from its sheath, the uncertainty and dangers of the operation begin; if the bistoury be introduced deep, the extremity of its blade wounds the fundus of the bladder; if it be introduced but a little way, it divides the gland but imperfectly, and makes the extraction of the stone laborious; if the blade be turned much downwards, it cuts the rectum; if turned towards the tuber ischii, opened widely, and drawn boldly, it

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* "Il n'étoit pas question de paroitre devant des juges, l'auteur du lithotome cachée auroit été le notre: persuadé de l'excellence de son instrument, il ne pouvoit prevoir que plus de reputation et de gloire, en venant partager ses lumières avec nous."

divides the pudic artery, so that the patient bleeds to death.

Each of these dangers is what might be predicted of this operation, and most unfortunately each of them is ascertained by the most melancholy proofs: for Frère Cosme had, by this blindfold slash of the bistoury, committed more butcheries than Frère Jaques, Le Raoux, and all the itinerant lithotomists! like them, he was ignorant, rash, and unacquainted with surgery! Louis, the panegyrist of his operation, found himself bound in honour to acknowledge the facts; and Frère Cosme was so secret in his operations, so jealous of admitting strangers, or any that were not entirely attached to him*; his conduct was so widely different from that of Frère Jaques or Le Raoux, that the Academy were naturally inclined to believe that there must be some danger where there was so much mystery in the operations of this Frère Cosme, and were vindicated in receiving the following facts, on the testimony of various surgeons.

"Often the prostate was so imperfectly cut, that the resistance from the undivided gland occasioned a most laborious operation; sometimes Frère Cosme struggled in vain, for half an hour, trying to extract the stone, and was forced to introduce the bistoury a second, and even a third time, raising the knife to a higher degree, (for the rising of the blade was graduated by a scale) in order to make a wider stroke." "In cutting M. de Chery, Lieutenant-colonel of the regiment de Saintonge, he introduced his forceps twenty times, and, after having ten times brought the stone to present under the pubis, at the lips of the wound, after exhausting the patient with fruitless and dreadful attempts, he was obliged to introduce the bistoury again, and enlarge the wound. The stone was indeed extracted, but the patient died." "Frère Cosme again, in cutting a priest of St. Lazare, of Fontainbleau, laboured a full half hour in the extraction of the stone; three several times did he introduce his bistoury, and repeated the incision. This patient also died in twenty-four hours."

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* "Il prend un grand soin d'opérer le plus secretement qu'il lui est possible; il n'admit que des temoins affides autant qu'il le peut; cette conduite est tout-à-fait differente de celle qu'ont tenue Raoux, le Frère Jaques, et tous ceux qui se sont donnés pour inventeurs de méthodes particulières. La confiance que quelques succès leur avoient inspirée les portoit à augmenter le nombre des temoins de leurs procedes, ils cherchoient des approbateurs, le concours des spectateurs de leurs opérations étoient prodigieux."

"When he cut Moreau, professor of philosophy in the college of Montaign, the forceps passed into the bladder with the greatest difficulty, and that only after repeated attempts, and with the help of two buttoned probes or conductors. The forceps were six times introduced, and always with the same difficulty, which clearly proves an imperfect section of the prostate; the patient lay for half an hour under his hands; the hæmorrhagy was stopped with great difficulty, and so imperfectly, that on the nineteenth day the patient died."

"Frère Cosme had the ignorance to cut for the stone a young man, in whom the stone was so lodged in the neck of the bladder that a small incision with a common scalpel, by cutting upon the gripe, would have saved him: yet in this case Frère Cosme had the cruelty, when making a second stroke with his murderous knife, to gag the patient, and make his mouth be holden by a servant of the hospital to prevent his cries. This young man remained long fistulous, and in all probability never was cured*."

"The rectum was found to be cut on opening the body of a priest of the parish of St. Roch, cut by Frère Cosme." "M. Boucot, surgeon at Troyes, acknowledged that in dressing one of his patients, cut by himself with the bistouri cachée, air and fæces issued from the wound."

In many of Le Cat's operations the great pudic artery was cut, so that the patient died almost immediately. In some cases, the greater branches of the pudic artery were divided; the bladder was so filled with clotted blood, as to occasion a desire to pass the urine, with intense abdominal pains; the clotted blood being removed by injections of tepid water, the hæmorrhagy continued incessantly till the patient fainted and died. "A curate of the diocese of Sens, being cut in La Charité with the bistouri cachée, bled profusely; the bleeding was stopped by the introduction of a canula, but, returning three times during the first fifteen days, the patient expired on the sixteenth, exhausted with loss of blood." "Le

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* "Un jeune homme de vingt-un ans qu'il a taillé à L'Hotel Dieu de la Ville de Nantes. La pierre étoit engagée dans le col de la vessie; il jugea qu'elle en remplissoit exactement la capacite, et se servit de son instrument sur l'idée qu'il avoit prise du volume excessif de la pierre; après des tentatives inutiles, il fallut revenir a l'instrument tranchant. Le malade souffrit beaucoup, et pour l'empecher de crier on lui faisoit fermer la bouche par un infirmier. Après un grand quart d'heure de travail, on tira la pierre, qui n'étoit point grosse, et pour l'extraction de laquelle on auroit dû pratiquer tout simplement le petit appariel, et se servir du crochet à curette, dont tous les praticiens connoissent l'utilité en pareil cas."

Sieur Forceville died on the seventh day, of a slow hæmorrhagy, which had never ceased from the moment of the operation."

"Frère Cosme performed his operation on Mr. Crin, judge of the city of Compiegne, on the 9th of November 1754. After many ineffectual attempts, he at last succeeded, with the curved forceps, in extracting a small stone (weighing only half an ounce). The patient was, as usual, laid in bed without any dressing, notwithstanding a degree of hæmorrhagy from which he was very faint; two hours after the operation, the blood continuing to flow, Frère Cosme was forced to introduce a silver canula into the wound, wrapped round with agaric. About mid-day Mr. Crin desired most importunately to be allowed to pass his water. The bladder was injected with tepid water through the canula, which was then withdrawn; but by six in the evening, the hæmorrhagy having been incessant, the patient fell into faintings, and expired in presence of Frère Cosme."

These authentic and impressive facts will bring home a most instructive lesson to the minds of those who have supposed it possible to substitute mechanism for skill, and to forge instruments of so happy a shape as to perform a dissection at one single stroke. These facts give the lie at once to all the vain promises of the inventor, who boasted of this as the chief excellency of his invention, that the bistouri cachée might be safely put into the hands of any surgeon, since it was guided as easily and surely by the most ignorant, as by the most skilful *.

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* "Delà on a conclu que le nouveau lithotome pouvoit être mis avec confiance entre les mains de toute sortes de chirurgiens, de

He compared the bistouri cachée with a pair of compasses, which, being opened to a certain degree, make circles of like diameters, whatever hand turns them; but he little considered the variety of size and texture of these parts in different subjects, and their mobility and variable posture in all subjects, the slightest turn of the hand giving a different effect to the stroke of the knife. No graduation of the handle can regulate the incision among parts so moveable. In place of being an instrument equally safe in any hand, it is equally dangerous in the hands of the skilful and of the unskilful. Nothing, surely, can be more insulting to common sense, than to say the virtue is not in the operator, but in the knife! yet it is no wonder the Friar boasted of this quality of his knife, for in himself there was none! this was the only privilege he could lay claim to! If his knife was so contrived that with it any rude or ignorant man might operate safely, the inventor of such knife was indeed entitled to operate! Frère Cosme did accordingly put this in the front of his essay, which was inscribed, "The Description of an Instrument for Cutting for the Stone, adapted to all Capacities*."

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differens degrès de genie et d'adresse: que tous feront uniformement la même operation, sans crainte de manquer de precision qu'elle sera executée aussi parfaitement par l'homme qui a le moins d'experience que par lithotomiste le plus consommé. Ce sont les proposes expressions de ceux qui ont loué le nouveau lithotome.

[*] The title under which he describes his knife is, "Description d'un Instrument avec lequel elle sera facile à executer la Taille par tous les Chirurgiens."

This operation of Frère Cosme is in the present day performed in London by a few surgeons. But I am not aware that success has removed the original objections stated here.

OPERATION OF M. FOUBERT, SURGEON IN PARIS, AND MEMBER OF THE ROYAL ACADEMY.

When once the principle is openly avowed, of substituting mechanism to skill, and inventing instruments by which an operation may be performed even by the ignorant, all restraint vanishes, and one invention follows another in rapid succession. This is a pleasing and ready indulgence; ingenious trifles are easily invented; idle men are glad to find this short way to distinction and celebrity, and well pleased to escape the labour of study. While the man of real knowledge, who studies his profession faithfully, and is familiar with dissection, feels that he could accomplish whatever he designs with the common knife, and thinks of no other; the indolent man, inspired, as he imagines, with a genius for inventing new operations and curious instruments, sits and contrives ingenious things, which his friends never fail to praise, while all the world besides disregards them.

Foubert was one of those, who, being deceived by the report of Albinus, believed that Rau made his incision into the body of the bladder only, and behind the gland, and he imagined that the best of all operations was that which saved the urethra and cervix vesicæ (viz. that part which is surrounded with the prostate gland) entire *.

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* "Les reflexions que j'avois faites sur la methode de M. Rau, telle qu'elle est décrite par M. Albinus, me firent entrevoir que la perfection de l'operation de la taille consistoit à ne point interesser le col de la vessie ni l'uretre, et a procurer à la pierre une sortie par l'endroit de plus large de l'angle que forment les os pubis; il me parut que le lieu le plus favorable pour entrer dans là."

Foubert designed to make his way directly into the bladder by one stroke of the knife, without any of the usual incisions, and for this he invented the instruments which are presented along with the plan of his operation. He first passed the forefinger of his left hand into the anus to guard the rectum, by pressing it aside; he next, with the forefinger of the right hand, sought out the tuber ischii, and, having marked that point, he struck a slender trocar and canula directly into the bladder, the trocar passing in the middle betwixt the anus and tuber ischii, and he knew that it had penetrated into the bladder when the urine issued through the trocar: then retracting the trocar a little, without drawing it quite out of the canula, he introduced the point of a slender knife into a groove or slit in the canula; by the guidance of that slit, he ran it onwards into the bladder, and was aware of the knife having actually reached the bladder, by the urine flowing still more freely: then, raising the knife from the slit of the canula, he made his incision, about an inch and a half in length, through the neck of the bladder, by moving the knife from that point at which it had entered upwards towards the pubis: and finally, by moving the handle more largely than the point of the knife, he opened the outer part of the wound to whatever degree the size of the stone seemed to require, and then, withdrawing the knife, he introduced a blunt gorget to guide the forceps. His trocar entered behind the prostate gland, above the ureter, and so passed into the body of the bladder. Foubert vainly imagined that he was at once imitating both the operations of Rau and of Celsus, and fulfilling the true theory of lithotomy, that whatever faults might be imputed to his operation, the danger of fistula could not be of the number, since the urethra and cervix were left entire. How vain such expectations were, I have already proved: yet it was for this excellency chiefly that Louis commends Foubert's method, saying, "Les voyes naturelles de l'excretion de l'urine et de la matière prolifique ne sont lésées en aucun manière."

Mr. Thomas, another ingenious member of the Parisian school, improved Foubert's operation to the highest point of absurdity, by striking his trocar, not near the tuber ischii, but into the highest point of the perinæum, close under the pubis; reversing the order of incision, he made, in a downward direction, that incision which Foubert had made from below upwards; and finally he joined to the canula a concealed knife, which, upon pressing the handle, rose out of a groove. Here all kinds of rashness were effectually combined; the adventurous and unguided plunge of Frère Jaques was exemplified in the driving in of the trocar; the inadequate, and yet dangerous and irregular incision of Frère Cosme in this concealed knife; and, by directing the edge of this knife downwards, he multiplied all the dangers by turning it directly against the rectum and the pudic artery.

Our judgment on these inventions must be naturally guided by what we know of other experiments and other inventions. If it was dangerous to go so deep as Rau was supposed to do, although he made his way to the body of the bladder, by a deliberate and skilful dissection; what must it not be to strike a trocar into the pelvis under the pubis, without even a catheter (for Foubert used neither staff nor catheter) to guide it to the bladder, and then, without any dissection or any form of outward incision, to cut through all the parts with a slap-dash stroke of the knife? We know from experience, in the operation of Frère Cosme, the dangers to which the rectum and the pudic artery are exposed by such a stroke; we know how inadequate the incision made by such a movement of the knife is, to the complete section of the gland; we know that along with every other danger there is this peculiar to the unguided stab of Foubert's operation, that the operator may altogether miss the bladder. Frère Jaques, when he plunged his dagger-like knife into the bladder, was guided by a staff; he struck his knife into the apex of the hip, and, by enlarging his wound downwards as well as upwards, cut fairly the muscles of the perinæum, and provided a sufficient opening for the exit of the stone: but Foubert, striking his trocar by the side of the tuber ischii, and cutting only upwards towards the pubis, failed to cut the transverse muscle or to remove the chief obstacle to the extraction of the stone.

It is a paramount objection to all those operations in which the knife or other instrument is struck thus at random into the bladder, that the surgeon finds much difficulty in striking the bladder with his trocar in the most urgent of all cases, a suppression of urine, such as threatens gangrene, where the bladder, in short, is so distended as to occupy the whole cavity of the pelvis, exposing itself fairly to the stroke. Let it be always remembered by the surgeon, that the alternate fulness and emptiness of the bladder and rectum so entirely changes the place and form of each, that it depends altogether upon the state of distension of the bladder, what part of it you strike with the trocar, or whether, in aiming at the bladder, you do not rather plunge into the rectum. From every consideration, I hold it to be an indisputable axiom that the operation of lithotomy never can be safely made a plunge in the dark, but must be a deliberate dissection.

OF THE CUTTING GORGET OF SIR CÆSAR HAWKINS.

It is singular that the history of that operation which we now perform, or rather of that particular instrument with which we make the most critical part of the incision, is least of all known. There is a taciturnity about the Englishman, which even while he is proud of his invention, prevents any unseemly ebullition of vanity; he contrives an instrument, finds it useful, his friends approve it, and he says no more about the matter. The invention of the lateral operation of lithotomy by Chesselden, though a most interesting improvement, was but slightly mentioned by himself, or by his pupil the celebrated Sharp, but was fairly emblazoned by Morand. The invention of the cutting gorget by Sir Cæsar Hawkins was in like manner very slightly mentioned by Warner, and by Sharp, in his critical inquiry: but had it, like the operation of Chesselden, been described by the loquacious and eloquent members of the French academy, it might have made as splendid a figure as the bistouri cachée of Cosme, or the gorgeret-cistotome-dilatoire-composé of Le Cat.

Of all the changes on the operation of lithotomy, the invention of Hawkins's cutting gorget was the least observed, because it was a change not in the design of the lateral lithotomy, but merely in the form of the instrument with which it was performed. There were, besides, many previous inventions which prepared the public mind for the novelty; the instrument itself, the gorget, was not new, but had been long used as a dilator to enlarge the wound of the prostate, and as a conductor for guiding the forceps. The sole change proposed by Hawkins was to sharpen the edge of the instrument, that it might perform, at once, the double office of knife and conductor, and surgeons were apparently pleased with a contrivance which saved them from the responsibility of dissecting parts, with the anatomy of which all were not equally well acquainted;—experience alone has gradually proved how dangerous this gorget is.

"Mr. Serjeant Hawkins," says Sharp, p. 213, "seems to have fallen upon a most ingenious contrivance, not only for removing them (viz. the defects of the instruments used in lithotomy), but also giving the last hand towards perfecting the lateral operation; this he effects by making his gorget cut on the right side, so that when it is introduced upon the staff and pushed on into the bladder, it necessarily makes an incision on the left side of the urethra and prostate gland, and thus avoids the danger of wounding the rectum; and, as the internal incision is to be made in the same manner as when you propose to open the prostate with the knife, the extraction of the stone will be accomplished with all the same ease."

This operation is essentially the lateral operation of Chesselden and Morand; and the lateral operation, whether performed by the knife of Chesselden, the cistotome of Le Cat, the bistouri cachée of Frère Cosme, or the gorget of Hawkins, is still essentially the same, an incision extending laterally through the prostate gland, from the membranous part of the urethra, to the body or membranous part of the bladder.

In operating with the gorget, the external incision is made with the knife; the membranous part of the urethra is then opened, by turning the edge of the knife up towards the groove of the staff; the beak of the gorget is then fixed in the groove of the staff, which is to conduct the instrument into the bladder; the gorget, cutting laterally, is then thrust forwards through the gland; and when the urine rushes out, which is a signal of its being thrust home into the bladder, the forceps are introduced along the hollow of the gorget.

What objection then can there be, to an incision so fairly lateral, so apparently safe, so perfectly corresponding with the dissection of Chesselden? Many! of which one is principal and conclusive: the gorget slips! and all the surgeons of Europe confess it! it slips in the hands of the most skilful surgeons, and no one can be responsible for the consequences of a thrust so desperate, and requiring so much force: it slips so frequently, and is avowedly so little under the control of the operator, that no man ventures to blame his brother for a misfortune which may happen in his own hand. So imperfect is the instrument, and so dangerous this plunge, that to prevent the gorget being driven through the fundus of the bladder, is a point of so much importance as to occupy, to this day, the genius of inventors, who have thought to guard the edge by a double or slipping gorget! and so far is the incision, after it is safely made, from being adequate to the extraction of the stone, that the size and form of the gorget, and especially the expansion of its blade, the broadness of its cutting edge, varies every day: the instrument was once conical, but is now cylindrical; it was once narrow, but is now broad; it was once double, with the beak in the centre; it is now single, with the beak on one side; when first sharpened by Sir Cæsar Hawkins, it was round, because it had been immediately before a mere dilator; it is now flat, and entirely resembles a knife.

It is not without reluctance that I rank this among the inventions where mechanism is substituted for skill: if this form of instrument were found safe in practice, I should be as little apt as any man to be infected by speculative fears; but it is a murderous weapon! When the dash is made with the gorget, either it is at once successful, or, if wrong, is irretrievably so; for, though in operating with the knife you can make a second incision, in operating with the gorget, if you fail in the first, you can make no second plunge. The best operators of this country, among whom, I have no doubt, I may reckon Sir James, acknowledge the dangers of this operation in the fullest and most unqualified terms: "I have more than once known a gorget, though passed in the right direction, pushed on so far, and with such violence, as to go through the opposite side of the bladder *." I have myself seen it driven, God knows where, deep out of sight, up to the hilt, without one

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* Sir James Earle on the Stone, p. 53.

drop of urine issuing, without the operator ever reaching the stone *. Observe but the force with which the operator drives in the gorget; mark the struggle with which he disengages the beak of the gorget from the groove of the staff; hearken to the audible clack with which the beak of the gorget shoots off from the groove of the staff; and if this moment of violence do not conspire with the outcries of the unhappy patient to persuade you of the dangers of this operation, you can have but little pretension to either feeling or knowledge. Such is the rude violence with which the gorget is driven inwards, that Broomfield, even when operating with a blunt gorget, a mere dilator, burst through the bladder and peritoneum; his gorget went almost beyond his reach into the abdomen, while the bowels of the boy fell down among his hands †.

But there is one paramount objection, independent of the many dangers which attend this push of the gorget; the instrument, guide it how you will, makes an incision inadequate to the easy extraction of the stone! I have often compared the incisions I have made with the knife, and with the gorget, upon the dead body, and the observations which I shall

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* One gentleman in this city printed (after an accident of this kind) his vindication with this motto, "Extenuate nought, or ought set down in malice." It has been my fortune to hear more than one vindication publicly read, but I cannot say I thought them elegant compositions. The common way, I believe, is best,—to say nothing about it.

† Broomfield, like every man in his situation, has a special pleading on the relevancy of the libel. "I am of opinion," says Broomfield, "that the elongation of this lateral ligament (viz. of the peritoneum) was occasioned by the repeated screaming of the child during the paroxysms of the stone," p. 270.

"Nec Deus intersit nisi dignus vindice nodus."

presently submit to my reader will prove the fact. I have observed also, in the time of operating, how difficultly the opening of the prostate admits even the forceps, how impossible that such an imperfect incision should easily allow the extraction of the stone. In all cases of particular difficulty, where, using the privilege of an assistant, I have introduced my finger, I have felt distinctly the stricture of the gland, the greater part of it being left entire. The incision in the gland often admits the forceps so difficultly, that I am well assured the gland itself has sometimes, by the mere pushing of the forceps against this firm and narrow opening, been entirely separated from the urethra! and after the forceps are pushed successfully through this narrow opening, and the stone catched betwixt their blades, all that remains of the gland is inevitably lacerated with much danger and pain. But I would more willingly quote any authority than that of my own dissections or experience: Camper, who has studied the subject, says, "Incredibile est quàm parva plaga ab omnibus etiam dexterrimis infligatur; nunquam forcipem robustam exciperet nisi dilataretur. Hawkensius solo conductore, cujus margo dexter in aciem assurgit, idem præstat; omnes plagam dilatant, ut calculum extrahant: dilaceretur igitur semper vesicæ ostium et prostata," p. 14.

But higher and better authority remains behind. Dease was, if I judged rightly of his talents, a stern and rude surgeon, but perfect in all the theory and practice of his art; he was not very explicit in his communications with me, but, from his manner and the movement of his hand in demonstrating to me, rather than from what he said, I conclude that he cut after the manner of Rau, making the incision with the right hand, while he held the staff with his left. "In all the trials," says Dease, "that I have made with the gorget on the dead subject, I never found the opening into the bladder sufficiently large for the extraction of a stone of a middling size, without a considerable laceration of the parts. I have frequently taken the largest sized gorgeret, and could not find that, in the adult subject, I ever entirely divided the prostate gland, if it was any way large; and in the operations that were performed here on the living subject, if the stone was large, the extraction was painfully tedious, and effected with great difficulty, and in some cases not at all."

The gorget, like the knives of Le Cat and Frère Cosme, is a mechanical contrivance, for performing, at one stroke, an incision which should be made with intelligence, by slow dissection, large or small, according to the proportions of the parts: it reduces the operation to the level of all capacities: it abrogates all distinctions, and puts the most ignorant almost on a level with the most dextrous surgeon: it inclines every young surgeon, who has but seen the gorget thrust into the bladder, to undertake an operation, with the history, theory, or manual execution of which he is altogether unacquainted. If indeed this mechanism of the gorget and grooved staff were so perfect that the worst surgeon were really as capable of performing the operation as the best, there would be nothing to regret: but, unhappily, the theorem is expressly reversed; the best and most skilful surgeon is in this affair little better than the most ignorant; no man who knows the danger of this particular operation, would declare himself responsible for the event *. The gorget, if small and narrow in the blade, makes an incision inadequate to the extraction of the stone; if made broad, that it may cut fairly through the whole body of the prostate, it enters the pelvis with difficulty, passes close to the bone, and endangers the pudic artery; and still, however broad, does not fairly cut through the gland, nor make an adequate incision! It is the same blindfold stroke with the incision of Frère Cosme, having, beside, this peculiar disadvantage, that this peculiar form of knife, this cutting gorget, is not first insinuated into the bladder along the groove of the staff, and then drawn outwards, with the single danger of wounding the pudic artery; —but is dashed inwards upon the bladder, with the risk of either starting off from the groove of the staff, and so missing the bladder! or of missing the bladder by pushing the prostate gland off from its connexion with the urethra! or of plunging, not into the bladder, but into the cellular substance surrounding the rectum! or of being driven into the gut itself! or, worse than all, of plunging through the gland, through the cavity of the contracted bladder, and through the fundus, among the viscera of the abdomen.

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* The difference of operating with the knife and with the gorget is principally this: With the first you feel your way, the forefinger of the left hand is always directing the knife, and when the incision is made into the bladder the forefinger follows the knife; after which the incision is enlarged by the direction of the finger; but in operating with the gorget the cutting edge is far beyond the finger: not only is the gorget, but the forceps are introduced without feeling the state of the parts, and the surgeon is seen to pull with the forceps, without once having his finger in the bladder.

Often, I am persuaded, the lithotomist fails to seize the stone, from its having passed through such a wound into the cavity of the abdomen *.

One anecdote in surgery, one ingenious contrivance more, I do remember, and should be sorry not to commemorate. There was, in the time of Pallas, and while he studied in this country, an English surgeon, whose invention he praises, but, in charity (as I would construe it), does not mention his name; it was a pair of forceps with a deep groove, and in that groove a concealed knife. After making the usual incisions, this anonymous ingenious gentleman introduced his forceps, seized the stone, raised the concealed scalpel from its groove, and, turning the armed or sharp blade of his forceps towards the perinæum, towards the lower angle of the wound, cut in proportion as he extracted, and could not fail to have a wound perfectly sufficient for the passing of the stone. Pallas does indeed inform us, that various high considerations induced this ingenious surgeon to deprive the world of the benefit of this invention †. I wish a man of such inestimable prudence had been also the inventor of Le Cat's gorgeret-cystotome-dilatoire-composé, of Frère Cosme's bistouri, and of

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* This is the manner in which I have seen the patient lost. The gorget, instead of cutting the prostate, has driven the gland and neck of the bladder before it. The gorget being far enough in, the staff was withdrawn, and then the forceps were introduced. They were in the wound, but not in the bladder. Then began the plunging for the stone, and the squeezing of the prostate betwixt the blades of the forceps. Much injury was done, no stone found, and the patient died. The stone I afterwards found in the bladder.

† "Multa vero sunt atque varia, quæ hujus instrumenti usum dissuadent; et procul dubio perspecta, autorem commoverunt ut non inventum publici juris fecerit."

Hawkin's gorget! or that these ingenious gentlemen had been blessed with the prudence and charity of the inventor of the cutting forceps.

I will close this discourse with some thoughts of the celebrated Mr. Sharp, in his critical inquiry into the present state of surgery. The passage I am now going to quote has greatly attracted my attention, because I have been long persuaded that many have been employed in inventing instruments, who would have been better occupied in learning to operate. Sharp says, " A reasonable variety of instruments is an essential aid to surgery; yet it may be observed that this supplement to the hand has been so much attended to by most surgeons, that dexterity itself has not been sufficiently cultivated; and it is very remarkable, that in proportion as the art of operating has been improved, the number of instruments has been generally retrenched. Dionis reflects on the superfluity recommended by Scultetus; some of the moderns condemn Dionis for the same excess; and perhaps the future generation will discard many of those now in vogue with the present age; I am apt to believe that, should they attain to a farther perfection in the art of operating, than we are now possessed of, it will possibly be as much owing to an acquired dexterity, as to any mechanical inventions."

This is an opinion to which I subscribe with sincere good will; I hold in reverence the ingenuity which affords us new resources in a difficult science; but I must see such ingenuity founded on professional knowledge before I can add my tribute of applause; I hold in contempt those only who would substitute ingenious instruments to manual dexterity and a knowledge of the parts. There never was a man old and skilful in our profession, who did not feel confidence only in his own hand and senses; and this is rudely called prejudice! There never was a boy entering upon our profession who had not a taste, and, as he imagined, a talent for ingenious mechanism and new operations; a folly which has its natural cure in experience and real knowledge. Le Cat spent his life in trifling inventions, without ever being able to persuade his meanest or most servile pupil to operate after his manner. Rau and Chesselden were careful only to be thoroughly acquainted with the anatomy of the parts, and desired no more complicated apparatus to dissect with, than a knife and a staff. This is a fact, in itself, so convincing, that no argument could give it farther importance *.

OF THE MANNER OF OPERATING WITH THE SHARP GORGET.

Before I proceed to describe the several stages of the operation of lithotomy, there are some preliminary points to be explained, which relate not to the dress of the patient nor the height of the table, but to the main design of the operation, and especially to the posture of those very moveable parts, the rectum and bladder, with regard to each other, and the manner in which the surgeon should feel and ascertain every thing that is interesting to him. The kind

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* Some years ago I collected nearly twenty gorgets from the different shops of London, all differing in form, or in the shape of the cutting edge. Each of these were invented no doubt after some misfortune in operating.

and degree of distress which your patient suffers, will enable you to guess at the state of the parts; in a boy who cannot have passed many years in this condition, whose parents, from observing his pulling out the penis and pressing the thighs, and crying when passing the urine, can ascertain both the duration of his complaints, and the degree in which his health is affected, you are sure of every thing favourable for your operation; for boys are naturally healthy; the stone has not with them time to acquire any uncommon size, it usually is small like a gall-nut, and very rough and irregular on its surface; the bladder is not contracted nor ulcerated; you can feel the stone with the fingers, in the rectum, and press it forward so as to make it prominent in the perinæum; in a healthy boy with a small stone recently formed, you undertake the operation with confidence, and probably would choose to cut upon the gripe.—In an adult who retains much urine, and passes it freely, who, though the symptoms of stone are decisive, yet passes long intervals with little pain, in whose urine there is not great sediment of mucus, and seldom any blood, with whom the paroxysms of the disease, i. e. the temporary inflamed and irritated state of the bladder is not frequent; the bladder is probably capacious, the stone small, and the state of the parts most favourable for operating.—But the scene is sadly reversed when the patient, shrinking from the pains of the operation, has long endured the tortures of the stone: when he has endured this disorder for many years, he is pale, languid, and emaciated; the parts are unfavourable to the operation, and his constitution to recovery: he can retain but one or two ounces of urine: the bladder is, by its frequent contractions, thickened in its coats, and its inner and most delicate surface being in almost continual contact with the stone, he feels excruciating pains in the glans penis every time he passes his urine: when he walks, he has a gravitating and dragging feeling, accompanied with tenesmus or diarrhæa, from the increasing size of the stone, by which his paroxysms of particular distress are frequently renewed; his urine is so mixed with mucus, that, of the quantity which he passes into a glass for our inspection, the urine being poured off, one half remains a pure white mucus, and each paroxysm of pain, especially if it arise from walking, is accompanied with a discharge of blood: the day he passes in almost unremitting torture, and, during the night, he is every half-hour on his knees, straining to pass his urine with dreadful pain. In such a patient the bladder is small, contracted, subject to inflammation; from frequent paroxysms of the stone, the parts are in a state sometimes peculiarly disposed to inflammation, and never favourable to the operation, while the strength and constitution are exhausted by suffering and want of rest.

It is only when your patient is free from pain, when he has rested, and is refreshed, after the fatigues of the journey that has brought him to town, when he has had a long interval after a paroxysm of pain, when he is free from irritation and fever, and in no danger from the infection of any reigning epidemic, that you can venture to perform the operation. You do not wait, as formerly they did, for the more favourable seasons of spring or autumn; these seasons it was natural to prefer in France and Germany, where the winters are severe and the summers sultry and oppressive: in this country you have no other cares than to nourish and strengthen your patient, if exhausted, and to prepare him so by opiates and the warm bath, as to ensure a favourable state of the bowels and skin. The season of any epidemic disease is much to be avoided. I have frequently, during the prevalence of influenza or of dysenteric diseases, or erisypelas, been cruelly disappointed in the adhesion of wounds after common operations, in cases of the most simple incisions, as in the extirpation of a cancerous breast; but the inflammation, which merely prevents adhesion and retards the cure in common operations, produces in this, where the wound is so near the viscera, abdominal inflammation and death.

And let me advise the surgeon to be slow in pronouncing his opinion, to be careful to ascertain the existence of the stone, by sounding, and to feel it also by introducing the fingers into the rectum, and to establish and authenticate his own opinion by a regular consultation, before he presume to operate. He should almost live with his patient for some days, for, unless he inquire carefully into his history, he cannot proceed with confidence, or his confidence may draw him into dreadful errors. The patient may have no stone, but an ulcerated and thickened bladder; he may have a stone, but too small to require so dreadful an operation, one which the patient might be able to engage in the urethra, and pass naturally by drinking floods of diluents, and passing the urine upon his knees; a small stone, being impelled by the force of the urine into the urethra, sometimes forms there a sac for itself, and the sound grating along this small calculus, in passing along the urethra, persuades the surgeon of the existence of a stone in the bladder: a patient has been unfortunately cut for a stone so small, that it has been swept out along the channel of the gorget with the flood of urine, and none been found to seize with the forceps; at other times a small calculus, of a cherry-stone size, has been found in the hinge of the forceps, and such accidents have been mentioned with as much indifference as if the surgeon were not responsible for the cruelty and folly of thrusting a gorget into the bladder of a patient whose stone was so small as to be passed by the urethra. In short, these are accidents which nothing but uncommon precaution and a most faithful attention to the complaints, feelings, and whole history of the patient, can detect or prevent.

However distinctly the sound may plump upon the stone, and satisfy every one of its existence, the surgeon never is to omit introducing one or two fingers into the rectum; from this mode of inquiry, various circumstances may be discovered, and inestimable advantages arise to the surgeon, who, in place of imitating the motions of other operators, proceeds with intelligence and design. I hold this mode of examination to be little less important to the operator who cuts with the knife or gorget, than to him who cuts on the gripe: By introducing two fingers into the rectum he feels the staff distinctly, upon which he is to perform the most delicate part of his incision: he feels the position of the rectum, which he is to keep out of the way of his instruments: he distinguishes, through the walls of the rectum, the membranous part of the urethra, which is to be his aim if he cut with the gorget, and the prostate gland, which he is to divide, if he cuts with the knife : he feels the manner in which the stone lies in the bladder, which, after his incisions, he is to grasp with the forceps : if the stone be small, he may not feel it very distinctly ; but if it be large, it falls low towards the neck of the bladder, is easily felt, its very form may almost be distinguished, the staff being plainly felt passing under the stone, when large, and holding it in its bend or curvature. The surgeon, by occasional examinations, may almost estimate its size, and, if he do not expressly proportion his incision to its size, may at least avoid the error of making a great incision for a small stone, or the still greater danger of making a small incision when the stone is very large ; and when the stone is so large as to require to be broken by strong forceps, he may always be aware of the nature of the operation he is to perform. I remember to have been called to a consultation, in which the gentleman, who invited the consulting surgeons, wrote in these terms : "To consult upon the case of a patient who has a stone in the urethra, and another in the bladder." The patient, in fact, had laboured long under the disease, the stone had increased to an enormous size : upon passing the sound, it encountered the stone almost before it had entered the bladder, so low was the stone depressed by its own weight, and the patient's straining dilating in some degree the neck of the bladder and projecting into it. Upon examining by the rectum, I felt a stone nearly the size of the fist, and entreated the surgeon to have strong forceps in readiness to break it in case of difficulty. When we were met for operation, I used the freedom of asking, "Whether forceps were at hand to break the stone?" He said, "No; that he had sent for forceps such as I wished, but could not easily procure them." Then I said, "Sir, if you value your own reputation, or your patient's life, refrain from operating till you are better provided, which you may easily be to-morrow morning; to perform this operation in the ordinary way, will be murder." He turned about and proceeded with his operation: the scene which ensued was dreadful; two or three forceps were successively twisted, or broken; all present were in the most distressing perplexity. A gentleman bethought himself of a pair of large and strong forceps, which had lain as lumber among his apparatus; these were sent for to his house, and with them the stone was extracted; but the operator had never one moment refrained from labouring with one instrument or another; the patient had struggled under his hands a full hour, in the most dreadful agonies; I need hardly say, that in two days he died *.

Not to break the stone, when of so uncommon a size, is cruel and dangerous, and no one accustomed to this operation will scruple to do so for fear of fragments of the stone remaining in the bladder, for he must be conscious that he seldom operates without the forceps chipping off small fragments of the stone, which are more dangerous than the fragments of a stone designedly broken, as they are less observed.

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* I have preserved this stone.

The condition of the rectum and bladder should be an object of particular attention. The bowels must be emptied by a purge two days before operating, for fullness and irritation of the bowels will dispose to abdominal inflammation. The rectum must be emptied by a glyster on the morning of the operation, lest the fulness of the gut should expose it to be wounded. This, if not a fatal, is yet a blundering wound, of which the surgeon should be much ashamed: although, we have the best authority for affirming that the intestine may be wounded by the most dexterous operator; Chesselden acknowledged to Mr. Morand, that he had twice, in operating, wounded the rectum. As it is chiefly important to prevent the cutting edge of the gorget injuring the back part of the bladder, it is of the first importance, in operating with the gorget, to have the bladder full; the fullness of the bladder allows the staff to be turned easily to every side of the bladder, in feeling for the stone; it allows the surgeon to set the staff, before cutting, in the precise direction that he wishes to have it. The fullness of the bladder presents the fore part of its body, viz. that where the prostate surrounds it, fairly to the cutting edge of the gorget, and gives the bladder a steadiness to resist the push. This fullness of the bladder prevents the cutting gorget being driven through the fundus among the bowels, and the quantity of urine running off freely along the channel or hollow of the gorget indicates to the operator, that this, the most dangerous movement in the operation, is properly performed. The patient for this end must retain his urine during four or five hours in the morning of operation; in boys, and even in men, a linen rag must be tied round the penis to prevent the urine flowing off. The string must not be undone upon introducing the staff for operation, for the body of the penis is so compressible, that the staff passes as easily when the string is left, as when it is taken away. I have often been provoked to see the string taken off, the staff introduced, and the whole of the urine allowed to run off by the groove of the staff, in the very moment in which the surgeon is about to drive his gorget into the bladder!

Foubert, in performing his operation, depended more entirely upon the distension of the bladder, than those who operate with the gorget, for, without its being full, he was in danger of missing the stroke with his trocar; once, in operating, he found that not one drop of urine flowed upon striking in the trocar; he believed that he had actually missed the bladder; but he found, upon inquiry, that the man, being impatient of retaining his urine, slipped behind the screen while Foubert (for it was in the hospital) was operating upon another patient, undid the string with which the penis was tied, and pissed lustily, and then deliberately tied the string about his penis, came forward and presented himself for operation. Had Foubert been aware of what had passed, he must have delayed the operation till the following day.

As one great purpose of many things which the surgeon does immediately previous to the operation, is to ascertain the relative posture of the parts, and revive his own recollections of the several points, he should never fail to introduce the staff himself, though often this is committed to the assistant. May not an unskilful assistant drive the point of the staff through the membranous part of the urethra, and lodge it between the rectum and bladder, where, of course, the gorget when driven along will follow the groove? Is it not a satisfaction to the surgeon to pass the staff himself, that he may do it gently without irritating the parts; that he may feel and distinguish any rub from any small calculus, sticking in the urethra; that he may lodge fairly in the bladder that grooved directory, which is to guide the most important stroke of his knife; that he may plump his staff against the stone, and feel it distinctly before he operate; that he may, after introducing the staff, pass his finger into the rectum, feel how the staff lies, incline the handle of it to the right groin, and so protrude the heel in the perinæum where he is to cut? Will not the introducing and setting the staff and feeling its curvature, both in the perinæum and from within, give the operator more decision, and a more distinct recollection of what he has next to perform? To deliver the staff to the assistant, that he may introduce it, is a slovenly, a timid, or an evasive practice; I have seen this often done, but it always seemed to me that the man who dared to undertake the operation of lithotomy, was doubtful whether he could introduce a staff: or that he was so jealous of his reputation as a rapid operator, that he would not allow the more ignorant of the attendants to calculate the operation as begun, when he was only introducing the staff; or perhaps he feared lest his hand should be unsteadied by some slight opposition to the introduction of the staff! a part of the operation which should, in fact, by reminding him of all the important relations of the parts, inspire him with steadiness and manly resolution.

There is a gradation in the length and curvature of the instruments which are on various occasions to be introduced into the bladder. The catheter, as it needs not enter far into the neck of the bladder, though it should always be as big as the urethra will easily admit, should not be long, and should have a very gentle and simple curve. The sound, with which we feel for the stone, must be round, smooth, longer, and more curved; but it must not be very long nor much curved, lest it do not turn easily from side to side in the bladder; and it should be introduced when the bladder is moderately full, that it may be turned easily in various directions in search of the stone, which, if it be not found when the bladder is full, or the patient seated, or lying on the ground, may perhaps be felt after he has been permitted to empty the bladder, or allowed to stand up. The staff, or grooved sound, with which the surgeon means to operate, by cutting upon it with the knife after the manner of Rau or Chesselden, must be big, must have an acute angle at the place where it turns at the entrance of the bladder, and must be protracted beyond this angle into a long and straight beak, that it may be distinctly felt in the bladder; and its groove must be large and round-lipped, that it may be easily distinguished, and may guide the incision-knife or lithotome fairly: but the staff along which the surgeon designs to run the sharp gorget,—though it should have the same sudden angle or prominent heel, that it may be easily felt through the membranous part of the urethra,—though it should have the same wide groove, but with lips less obtuse or round,—should not be protracted into so long a beak, lest it should hold the knob of the gorget too long engaged in the groove, and carry it so deep as to endanger the fundus of the bladder.

The posture in which the patient is bound is horrible, most oppressive, but yet it is essential to the performing of an operation, where the slipping of one instrument, or the misgiving of one stroke of the knife, makes the difference—of safety or death. He must be made to grasp his feet with his hands, and secured in that posture by strong garters, encircling the wrists and ancles, and thus, bended into a curve, he rests almost upon one point of the spine, and is brought so near to the edge of the table, that he is almost suspended in air, by the two lateral assistants who support each a foot and arm. Unless the patient is brought thus far over the edge of the table, supported by the assistants, and his breech bolstered up by a pillow; unless his breech project over the edge of the table; unless the perinæum be turned almost directly upwards, and the surgeon seated low and rather under his patient, he cannot pursue his incision so far beyond the tuber ischii as he should do in order to cut the transverse muscle, for the incision should pass the curvature of the hip, as will be seen in the drawing (a) p. 140.

The patient should be brought out for operation, dressed in a loose gown, stockings, and slippers: his neckcloth should be loosened, or a light silk handkerchief put about in place of it: three medical assistants should support him, one on each side should hold, each, a leg and wrist, supporting the sole of the foot in the hollow of one hand; the third assistant should support his head and shoulders, and keep him forward according to the operator's directions. The table should be big, firm, and steady, covered with a folded blanket, with one or two small pillows placed for the head to rest upon, and one longer and bigger to support the breech, or rather the loins; a little sand should be strewed under the lower end of the table. A friend should stand by to speak to him, to encourage and support him, and to give him occasionally a little wine and water; and, as no unseemly confusion should be allowed, every thing on the table of instruments should be fairly arranged, and every attendant steady, silent, and observing. One only should hand the instruments; while the assistant surgeon, taking his place behind the young man who supports the right foot, waits there till the surgeon, having introduced the staff, and felt and placed it, lays it down towards the right groin, and gives it to him in charge; when he is to grasp it firm and hold it steady with his right hand, but without pressing hard, supporting the testicles and scrotum with the flat palm of his left hand, and pulling slightly upon them so as to stretch the perinæum and make it tense for the incision.

Upon the table are placed a decanter of wine, another of cold water, and a large glass of cool wine and water, which may be poured into a small tea-pot, as more convenient for the patient in the awkward posture in which he lies; a basin of warm water, with the forceps and scoops in it; and in this basin of water the surgeon heats the staff with which he chooses to operate. The staff he chooses, and the gorget suited to the size of the patient, and well and smoothly fitted to the groove of the staff, and the knife with which he is to cut, are laid on a plate upon a fine cloth or towel. These instruments lie on the plate; the staffs and forceps and scoops are placed in the basin of hot water; the sponge, for wiping the wound, in another basin of warm water: the needles, the lint, the dry sponges, or agaric, to be used in cases of unusual hæmorrhagy, together with the canula, round which the sponge or lint is to be wrapped in case it should be necessary to thrust a canula into the wound, lie behind the basins and apart; and along with these is to be laid, in another basin of warm water, a strong syringe, or a large glyster bag and pipe, for washing out any small calculi or fragments of a broken stone.—When the surgeon, advancing to the table, thus arranged, warms the gorget, and then sticks it in his girdle or apron string; warms the staff and oils it, with the purpose of introducing it; twists a towel into his girdle, for it is impossible to perform the several parts of an operation neatly with soiled hands; and leaves upon the plate only the incision knife, which his assistant hands him, upon receiving the sign; and sometimes also the gorget is left to be handed by the assistant.

The operation of lithotomy, as performed with the gorget, may be divided into these stages: First, The external incision, by which we divide the skin and the transverse muscle of the perinæum: Secondly, The internal dissection, by which we divide the fat and cellular substance, and the fibres of the levator ani muscle, and open the urethra: Thirdly, The settling of the gorget in the groove of the staff, and pushing it onwards through the prostate gland: Fourthly, The introducing the forceps, withdrawing the gorget, and grasping and extracting the stone.

OF THE EXTERNAL INCISION.

The general belief and the common description stands thus: "That you are to make your staff protrude in the perinæum, and to perform your external incision, by cutting upon the staff."

Nothing is more untrue; we cut far from the staff: and this unfortunate description occasions infinite perplexity to the young surgeon, who, in setting his staff, cannot make it be felt in that place where he must perform his incision, and who, having made his incision, and penetrated to a considerable depth without feeling the staff, continues in confusion and dismay.

The external incision relates not at all to the neck of the bladder, nor is it made upon the curve of the staff: it relates to the great hollow betwixt the rectum and tuber ischii; it is designed merely to open the way into this hollow, through which the stone is to be extracted; and the surgeon's chief care must be, after cutting through the skin and fat, to divide the transversalis perinæi muscle, and all the ligamentous fibres, which would, if left undivided, oppose the extraction of the stone. The incision begins at that point, an inch below the scrotum, where the heel of the staff is felt, and, departing from that point and leaving the direction of the staff, it passes over the great hollow in a line betwixt the anus and tuber ischii ; the incision is performed in the following manner :—The surgeon seats himself on a low stool ; the assistant draws the testicles upwards, to make the perinæum tense, and gives a slight pressure to the staff; the operator then lays his left hand flat over the right buttock of the patient, so that the palm of the hand lies upon the tuber ischii ; spreads out his fingers upon the perinæum, by pressing first two or three times with the point of the fore-finger at the root of the scrotum, he feels the heel of the staff; and then, by drawing the skin of the perinæum towards the left side with the points of the fingers, he makes the lurk betwixt the perinæum and the hip, even. Then, taking the knife (which sometimes, while stretching the perinæum, the surgeon holds in his mouth) in his right hand, he holds it lightly like a writing-pen, with the points of the thumb and three fingers ; begins the incision about an inch (in a big man) behind the scrotum, and carries it downwards, declining regularly towards the hip, till it terminates apparently upon the hip, for though the incision is carried regularly in the middle betwixt the anus and tuber ischii, yet, the skin being tenser to the side of the tuber ischii, the wound seems to decline towards that side. The extent of the wound being ascertained and marked out by this first stroke of the knife, three inches and a half in length, more or less, according to the bulk of the patient, or the size of the stone ; this incision beginning behind the scrotum, proceeding obliquely towards the hip, running in the middle betwixt the anus and tuber ischii, or holding off but a little from the anus for fear of wounding the rectum, will be found to have its centre nearly opposite to the anus; and if the whole length of the incision be three inches and a half, two inches of its length will lie before the anus, and one inch and a half behind. The fingers of the left hand, which at first kept the skin tense, are now withdrawn for a better use. The fore-finger now guides the knife, and the operator proceeds to dissect through fat and cellular substance, and muscular and ligamentous fibres, till the wound is free and open, till all sense of stricture is gone; for it is only by feeling opposition and stricture that we recognize the transverse muscle. When this hollow is fairly laid open, the external incision, which relates merely to the free extraction of the stone, is completed; and the operator begins to feel for the staff.

OF CUTTING THE URETHRA.

The incision thus made is into the hollow of the pelvis below the place of the staff, which is only to be felt in the upper angle of the wound. If it were his design to operate only with the knife, the surgeon would now push his fingers deep into the wound, and, by the help of the fore-finger, dissect from the urethra along the body of the gland, till he distinguished its thickness and solidity, and reached the back part of the gland; then plunging his knife through the back of the gland, and settling it in the groove of the staff, he would draw it firmly and steadily towards him, pressing the knife steadily into the groove of the staff, and then, the free discharge of the urine assuring him that the gland and cervix vesicæ were divided, he would lay aside his knife, pass the left fore-finger into the bladder, withdraw the staff, and introduce the forceps.

But in operating with the gorget, the next business after the outward incision is to seek out, not the body of the prostate gland, but the membranous part of the urethra; to find it, the operator turns his fore-finger towards the upper angle of the wound; feels for the staff close under the pubis, when it lies close upon the bone, hardly to be distinguished from it; and as the operator recognizes the transversalis muscle only by the feeling of resistance, he recognizes the membranous part of the urethra only by the nakedness of the staff. But it is safest to be very clear, to dissect fairly to the staff, to feel not merely the membranous part of the urethra, but the body of the gland. In this stage of the dissection you can do no harm; a fair dissection may save you the disgrace and danger of making three or four unsuccessful cuts at the urethra; you therefore keep pressing down the rectum, with the mid-finger a little crooked; with the fore-finger pointed nearly upwards, you guide the knife in dissecting along the naked part of the staff, and the body of the gland; and when all is fair, and you are prepared to strike into the urethra, you place your fore-finger upon the apex or point of the prostate gland; and, turning the edge of your scalpel upwards, you strike it firmly through the urethra into the groove of the staff, and draw it towards you, steadily, along the groove, till you have made an opening such as you cannot miss, about half an inch in length, into which you fix the nail of your left fore-finger, or of your thumb, and prepare to introduce the gorget *.

OF INTRODUCING THE GORGET.

Keeping his thumb-nail firmly fixed in the groove, the surgeon gives away the knife, and lifts the gorget; poises it, and then holds it firmly in his hand. He then passes the gorget into the wound, where it enters pretty deep before it reaches the staff; then, pointing the beak of the gorget to the groove of the staff, he lodges it fairly in the groove, and running it once or twice backwards and forwards to be sure that all is fair, and holding the gorget steady with the right hand, and reaching the left hand over the pubes to receive the staff from his assistant, he lays hold of the handle of the staff, holds it steady for a moment, then, moving the gorget with the right hand, feels by the left whether the beak runs fairly and smoothly in the groove; then, the two hands acting in concert with each other, the operator balances the staff and gorget, and, by making the two hands feel each other, prepares them for co-operating in the most critical moment of driving in the gorget; and when all is prepared for driving home the gorget into the bladder, the surgeon de-

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* I entreat those who are not perfectly confident to make their incision of the urethra more than half an inch in length; an incision of half an inch in length is just sufficient to be distinctly felt and to allow the beak of the gorget to be fairly introduced; but it is an incision which a surgeon unaccustomed to operate might lose, and fall into confusion. I advise him rather to slit up nearly the whole length of the membranous part of the urethra, when his incision will be nearly an inch in length.

presses the handle of the staff, so as to carry the point of it deep into the cavity of the bladder; his staff stands, at this moment, at right angles with the patient's body; he rises from his seat, stands over the patient, for an instant of time, balancing the staff and gorget once more, and, feeling once more that the beak is fairly in the groove, he runs it home into the bladder, pointing it rather upwards than directly backwards: then the urine gushes out; the beak of the gorget goes off from the point of the staff with an audible click, and the operator withdraws the staff with the left hand, as the conclusion of that movement with which he drives in the gorget with the right.

OF EXTRACTING THE STONE.

The moment the gorget is driven home, as it always is, up to the hilt (the thumb of the operator, which lies upon the gorge of the instrument, being actually within the wound), the fundus of the bladder is in danger,—for the horrid and unnatural feeling of being thus impaled excites the patient to press downwards, as in passing the fæces and urine; the bowels are forced down upon the bladder; the fundus of the bladder is forced, by this pressure from above, and its own natural contractions, upon the edge of the instrument; matters stand now in a very dangerous condition, and the best means of preventing harm is to introduce the forceps quickly! no time should be lost in the foolish ceremony of introducing the fore-finger to feel for the stone! Those who use only the knife, use the finger as a conductor for the forceps; but those who use the gorget as a conductor for the forceps, cannot feel the stone with the finger, for it lies under the gorget, and the gorget exceeds the length of two fingers.

The moment the gorget is thrust home, the operator withdraws the staff, and gives it away; takes the handle of the gorget with the left hand, and the forceps in the right; the chops of the forceps being close, he passes them along the channel of the gorget, and the moment the right hand has introduced the forceps, the left hand withdraws the gorget. Then the operator, taking the handles of the forceps, one in each hand, begins to feel for the stone; the forceps must, by passing along the gorget, inevitably pass over the stone; let him, therefore, taking the two handles of the forceps, one in each hand, stand high above his patient, point his forceps downwards towards the bottom of the pelvis, to that sac or bulging of the bladder, in which the stone usually lies, and there he, in nine of ten cases, will encounter the stone; if he feels it with the forceps, and cannot seize it, it is because he has passed over it, and touches it only with the lower side of one of the chops. When he feels that he presses the stone with the point of the forceps, he then opens the blades with both hands, grasps the stone, tries the hold he has of it in a way which it is impossible to describe, then, by grasping very firm with the right hand, at the extremity of the handles, he holds the stone firm, and, by laying the left hand on the forceps, and holding with it also, he assists the right, confirms the hold, and prevents at the same time (by slipping his left fore-finger into the hinge) any undue pressure such as a soft stone will not easily bear.

Having thus fixed his hands, he begins to pull; and if the stone be small and the incision free, it comes easily and smoothly along. But I have observed that the young surgeon, when he feels the slightest opposition, expects to succeed by turning, twisting, and every kind of unmeaning violence, and has no absolute rule for a stage of the operation, which should yet be performed with an intention and manner as determined as any other. If the surgeon holds firm and pulls in one uniform direction, though he had the strength of a Cyclops, he could not succeed; if he turns and twists his forceps from side to side, "this way and that way, çà-et-là," as if he were dilating, not extracting, according to the directions of Paræus, since he is pulling without any design, he still has but little chance to succeed. If he will but reflect on the operation of the forceps, that the forceps are two levers with which he is to act alternately, depressing first one side of the stone, then the other, he will not scruple to adopt that decisive manner in extracting, which, though it seems harsh, is really easy, and relieves his patient the most speedily, and with the least violence. Let him, after having seized the stone fairly, press the handles of his forceps first down, then raise them up, then depress them again, with a wide and free motion, and he will be sensible, that by this slow and equable motion, the parts are little bruised by the cheeks of the forceps, and the stone will be, in a few strokes, brought to the mouth of the wound, and turned out, by one wide but gentle movement, into the left hand of the surgeon, which is held with the palm upwards ready to receive it.

OF THE CAUSES OF THE SLIPPING OF THE GORGET.

It will be easily perceived, that the critical movement on which the fate of the patient depends, is the cutting the urethra, the lodging the beak of the gorget in the groove of the staff, and the driving home the gorget. In attending operations, I have observed in this moment such a degree of hesitation and evident alarm on the part of the operator, as convinces me that it is a most important duty to explain the various causes of the gorget slipping off from the groove of the staff: he will best guard this accident, who is aware of every possible cause: it proceeds, like every important error, from want of knowledge in anatomy. Since a surgeon has been seen seeking the femoral artery for an hour, to tie it in a sound thigh, (the aneurism being in the ham,) we need not wonder if such an executioner mangle the urethra in attempting to perform lithotomy, and conclude with thrusting his gorget betwixt the bladder and rectum.

First, It sometimes happens, that the surgeon, deceived by the common description, and expecting to cut his incisions fairly upon the bend of the staff, goes deep into the hollow of the pelvis, and yet, after much dissection, feels no staff;—falling, then, into confusion, and anxious to be relieved from this distressing scene, he begins to believe that he must somehow have cut the urethra, and, believing this, he at a venture thrusts in his gorget. Sometimes the surgeon, having felt the staff, and distinguished the membranous part of the urethra, and turned up the knife, cuts into the groove with so tremulous a hand that he hardly wounds it; and having failed to dissect the urethra naked, before making this incision, the fibres of the levator-ani muscle close upon the small slit which he had made in it, and thus, after feeling distinctly the groove of the staff, he loses it again, and his gorget passes betwixt the bladder and the rectum.

Secondly, Confusion and alarm in the simple business of cutting the urethra, is a sure indication that the surgeon is in danger of doing something very terrible. Often you will observe the surgeon, in place of turning up his knife at once, and striking it steadily and firmly into the groove of the staff, lay down the knife, and lift it alternately several times; first he believes that he has cut the urethra, and then again becomes sensible, either that he has not cut it, or that he has lost the small slit that he had made. I have seen the operator give away the knife, receive the gorget from the assistant, point it at the groove of the staff, and try to introduce it, resume the knife, and make new incisions in the urethra, five or six successive times. I have seen the gorget driven twice, not into the bladder, but deep among the bowels, for although there was a stone, the surgeon never reached the bladder, never one drop of urine flowed, the stone was not extracted, and the boy died. This last mistake is mere butchery: the first is little short of it, for if every time that the surgeon resumes the knife, he has lost his first incision and makes a new opening in the urethra; if every time that he loses one incision, the urethra has turned in some slight degree upon the staff before he makes another, the successive incisions will almost entirely separate the urethra from the bladder, and the slightest push of the gorget will drive off the gland from the urethra.

Thirdly, There is much, too, in the direction in which the gorget is driven forward; for though the urethra be fairly cut, yet the angle at which the staff is held, or manner in which the beak of the gorget is laid to the groove of the staff, may disappoint the surgeon of his purpose, and make the gorget shoot past the bladder, or push off the gland from the urethra. If the handle of the staff be too much depressed, so as to turn its point high up towards the fundus of the bladder, while the gorget is pointed too low towards the rectum, the gorget, in place of entering smoothly, will start off from the staff: or if, on the other hand, the handle of the staff be held too high, is too near the groin, too much in its first position, and the gorget pointed much upwards, the directions of the groove and the beak of the gorget will not correspond; the cutting edge of the gorget will not be so directed as to cut its way forward; the beak will hitch against the point of the gland, and may, especially if the urethra be mangled, force off the neck of the bladder and prostate from the urethra.

Fourthly, The surgeon, in place of moving the gorget along the groove of the staff, sometimes allows both gorget and staff to go together deeper into the bladder, till they touch its fundus; sometimes the operator, by an awkwardness in the posture of the gorget, needs to use such force, that the gorget, when it starts through the first obstruction at the neck of the bladder, may (especially in a contracted bladder) wound the fundus. Even the forceps, blunt as they are, may, by rudeness and ignorance, be driven through the fundus of the bladder, the stone escaping by the rent, where the forceps cannot follow it into the cavity of the abdomen. Those who prefer the gorget, and regard it as the ultimate improvement of this operation, avow these facts. "I have more than once," says Earle, "known a gorget, though passed in a right direction, pushed on so far and with such violence, as to go through the opposite side of the bladder."

Fifthly, If the staff be short, and the assistant unskilful in the management of it, he may, after the surgeon has cut the urethra, allow the staff to recede from the bladder; and, in thrusting it back, push its point not home again into the bladder, but out through the wound in the urethra! The staff being thus lodged betwixt the rectum and bladder, the gorget must follow it; the surgeon feels the groove of his staff quite naked, fixes the beak of his gorget, and drives it home in the true direction, but no urine flows! upon introducing the forceps, he feels no stone! he is in the end, after much violence, obliged to put his patient to bed to die. Such an accident is recorded by Mr. Earle; it proves the dangers of this particular operation with the gorget, and the superiority of that with the knife; the plunge of the gorget, to those who know how to operate only with the gorget, is irremediable; but a surgeon perfectly acquainted with the parts, and skilled in dissection, would, in such a case, introduce his finger, feel for the prostate, strike his knife into it, and, putting in his finger, guide the forceps into the bladder, and at least extract the stone if not save the patient. Cheselden once performed this, when another operator had failed, and pushed his instruments betwixt the bladder and rectum.

Sixthly, Though the gorget has passed right, the forceps may be directed wrong, for after a first attempt at extraction, and when the forceps have slipped, the scoop or finger are introduced, and the forceps re-entered; but the opening which the gorget makes does not very easily admit the forceps, even when the gorget lies in the wound to guide them; after the gorget is withdrawn, the forceps enter with greater difficulty, they slip more easily in among the loose cellular substance of the rectum. The operator opens the forceps, and feels in vain for the stone; he at last has an indistinct perception of the stone, closes them upon it, grasps it, and begins to pull; but the forceps slip; the bladder is betwixt the stone and the forceps. These are the true sacculated stones, but the sac is the bladder, and the cavity is that which is made among the cellular substance of the rectum by the turning of the forceps in search of the stone, and the opening their blades violently to grasp it. In one unfortunate case, the surgeon, groping thus upon the outside of the bladder, actually grasped with the point of his forceps, and twisted away, the great part of the prostate gland, which, when he had thrown it down among his feet, was picked up by a professor of anatomy who assisted at the operation, and when the gentleman died the parts were dissected out, and are preserved.

It is unquestionable that the gorget is often thus plunged among the viscera, and perhaps it is to be lamented that ever cutting for the stone ceased to be a distinct profession, or that the operation was brought to that kind of perfection which induced ignorant men to venture upon an operation which, even thus simplified, requires consummate skill and knowledge. Whatever may be the apparent facility of this common operation with the gorget, that with the knife is alone secure, it is indeed to the last degree simple, as simple as that of cutting on the gripe; for it is cutting with the knife upon the staff, which is more easily held, fixed, and directed, than the gorget. But since the operation with the gorget has been approved, and will continue to be performed, I have taught it faithfully; nothing can, in my opinion, so well prepare the young surgeons against this fatal accident, the slipping of the gorget, as knowing perfectly the causes from which it may arise.

If the perinæal artery, which is unavoidably wounded, is large, and bleeds profusely, it is usually tied with the needle after the external incision, and before the urethra is cut. If the hæmorrhagy be neglected till the operation is finished, the arteries are then so bruised, and so retracted among the cellular substance, that they never bleed again; if there be any internal hæmorrhagy from arteries larger than common, coursing round the prostate gland, and cut with the gorget, it is discovered only some hours after the patient is laid in bed; it is known by the desire to pass urine, the sense of load at the lower part of the abdomen, and restlessness and pain; and it is relieved by pushing in the finger, and breaking down the coagula, which are then discharged as from the uterus in an abortion; and then, if fresh blood continues to flow, farther danger is prevented by thrusting a wide canula into the wound, surrounded with a piece of dried sponge, the canula being passed through a hole in the centre of the sponge*.

The stone being extracted, the surgeon, having examined and assured himself that there is no second stone, lays a piece of oiled lint within the lips of the wound; unbinds the patient, and lays his thighs together, the knees being bended, and an assistant holding his hand flat over the wound, and the patient is conveyed to bed, and laid at first on his back. An opiate is given with a glass of warm wine and water; the curtains are drawn, the windows closed, and a medical attendant being left by him to watch any accession of hæmorrhagy, or abdominal pain, he is composed to rest; the urine which flows freely through the wound is received upon a thick folded cloth. The warm bath, glysters, bleeding, if he be an athletic man, and embrocating the lower part of the belly with spirituous applications, are the chief means for preventing abdominal inflammation.

I hope that, in preparing my reader for understanding this description, I have with proper seriousness inculcated the importance of study, and the fatal consequence of imitating, without intelligence or design, the motions of other operators; that I have not, by any presumption on my part, incited the young surgeon to any rash or unpremeditated attempt or new exploit, but have described perspicuously, simply, and with a sincere sense of duty, the most important and eventful operation in surgery.

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* The transversalis perinei must be cut, but dangerous bleeding does not come from it. If the pudic be cut, it must be tied by the tenaculum or needle. But if the artery of the penis, by running close on the prostate and the neck of the bladder, be cut, I know no way of securing it but by laying hold of it with the old artery forceps, and letting them remain for the night. This is a dangerous and most perplexing accident.

Whether I have written too much or too little, is a question which some will be very willing to propose; but our general profession, a learned, impartial, and honest jury, will decide: but this I am sure will be allowed me, the merit of good intentions, and the choice of a subject interesting in itself, and in its relation to many important points of surgical practice.

[As a concluding comment on my brother's observations, I must remark that he can never be a safe operator who cannot perform the operation with a scalpel. The question is not with what instrument the operation is to be performed, but more as to the mode of its performance; that is to say, is he to adapt one instrument to another, and so, by a sort of mechanical contrivance, make his way into the bladder? or, is he to divide the parts which he knows as an anatomist and feel his way, distinguishing each part as he cuts it? and is he to pass his finger into the inside of the bladder, to examine its condition? or, is he to pass the gorget first and then the forceps, and so commence a search for the stone with the forceps, without having previously ascertained the condition of the bladder, the state of the prostate, or the size or place of the stone? I shall here describe what I conceive essential to a good operation. The surgeon is, in the first place, particularly anxious, by repeatedly sounding the patient in different positions, to ascertain the place where the stone lies, and if it be moved in consequence of the change of position; he ought particularly to sound the patient placed in that posture in which he is to lie during the operation. I have known mistakes from the neglect of this; the surgeon has sounded in one position of the body, he has operated in another, and consequently he has missed the stone in the place where he expected to find it. By sounding, too, he makes some estimate of the size of the stone, he feels either that it is moved from one part of the bladder to another, or that he can put his sound on two sides of it.

When he introduces his staff for the operation, he feels the stone, and estimates exactly the place of it in reference to the position of the staff. He gives the staff into the hands of his assistant, bidding him keep it in contact with the stone, and requesting him to take care that he neither weighs too heavily on the staff, nor draws it up too much under the arch of the pubes.

It will not signify much in what direction he makes his incision, that is, upwards or downwards, but let him not suppose that he has made his incision when he has only divided the skin. He must put in his knife dagger-ways, so that he may cut deep betwixt the ramus of the ischium and the anus. My mode of doing this part of the operation is, first to pass the point of my finger into the anus, and then to pass the point of the knife by the side of the anus, and betwixt it and the bone, and so to divide the integuments upwards. Having made an incision, into which I can put the ends of my four fingers, I begin a more careful dissection; and putting the fore-finger of the left hand into the wound, and pressing the rectum downwards, I divide the transversalis perinei, and by repeated touches of the knife reach the surface of the prostate gland. This *dissection* is what is usually called the first incision, and sad work must the young surgeon make of it, who believes that he is to divide all that ought to be divided by one incision.

The operation so far prosecuted, it will not much signify by what instrument the neck of the bladder is divided: but the operator will now find it an easy matter to distinguish the staff in the membranous part of the urethra, and to insert the point of the knife into the groove of the staff betwixt the bulb of the urethra and the prostate gland. By carrying the knife forward, he will divide the prostate, and slipping the fore-finger of the left hand after the knife, he will have his finger in the bladder, and still feeling his way, he will, either with his scalpel, or exchanging it for the bistoury, enlarge the incision horizontally or laterally.

The wound in the bladder should now be dilated with the finger, with a view to the passing of the forceps along the groove of the staff; but if any difficulty be experienced, the operator must pass a *blunt* gorget along the finger to direct the introduction of the forceps. I must add, that I have not found this necessary.

The operator having introduced the forceps into the bladder, will not plunge about for the stone, but having previously ascertained its place, and having touched it with the finger, he will direct the forceps against it, and having felt it with the forceps, he will withdraw the staff; and now opening wide the forceps, he will grasp the stone, and extract it in a direction downwards, moving the forceps at the same time from side to side.

I must here say a few words in favour of the lever. It is introduced easily; it ascertains the presence of the stone better than the forceps; it occupies less space; you can have both it and the finger of the left hand in the wound at the same time; and in extracting the stone, there is no danger of crushing the stone, and no danger of catching the prostate, or the cut edge of the bladder.

Reflecting upon the cases of lithotomy which have terminated unfortunately, there appears to me no subject of more importance than the extravasation of the urine. Modern lithotomists have been inattentive to this subject; the recommendations they carefully give, of closing the thighs, and keeping the lips of the wound together, is to me a proof that they have not noticed the unhappy consequences of the aglutination of the wound during the first four-and-twenty hours. This is the condition of the parts; the knife or the gorget has opened the cellular texture between the pubis and the bladder; the outward lips of the wound are closed by coagulation of blood, or a process of adhesion; the patient suffers accumulation of urine in the bladder, until at last excited to powerful effort, the urine is propelled into the cellular texture, gets under the peritonæum, and, at an after period, inflammation and suppuration there carries off the patient.

It is a thoughtless thing for an author on lithotomy to say, that the urine generally comes by the penis on the second or third day, but after this it flows again by the wound. Now what is this, but the tumefaction and aglutination of the lips of the wound preventing the free evacuation of the urine? And it is lamentable to think, what mischief is done in this short period: every thing may have hitherto gone on well, and even the very perfection of the operation be now converted into a cause of death, for a tedious and bungling operation, where instruments are twenty times introduced, leaves the wound in no disposition to unite, while a simple and decided incision, and the stone easily extracted, leaves the wound in a state prone to this partial aglutination.

Now we see the reason why an experienced lithotomist visits his patient a few hours after the operation, and cruelly but kindly thrusts his finger into the wound, breaking through the coagulum, and allowing the urine and serum a free exit. There is another way; oiled lint may be put upon the sides of the wound and pushed deep, and then an assistant may withdraw these four hours after the operation; but I conceive it much better to use the canula, it is safer, relieves the operator's mind from that anxiety which he must otherwise suffer, and there is no seeming cruelty or rudeness necessary. A tube of elastic gum is surrounded with proper dressing, dipt in oil, and then introduced into the wound, so that its extremity may lie just within the lips of the prostate; it is attached to the T bandage, does not distress the patient by its presence, permits the urine to flow, and prevents the distension of the bladder; it is to be finally withdrawn on the evening of the third day.

DISCOURSE IV.

OF INOSCULATION *.

A General Sketch of the Arterial System; of the importance of Inosculations to the general health and preservation of the body; of the frequent interruptions of the great arteries, and of the retrograde motions of the blood.

Horror at the sight of blood is perhaps one of the most natural feelings, and next to that is the apprehension, that if hæmorrhagy were suppressed by tying up the main artery of a limb, gangrene and death would ensue! Gangrene has always been the greatest terror of the surgeon, and the tying a great

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[* It is to be wished that the reader should peruse this section of the work with the utmost attention, both from a regard to justice, which involves the best interests of the medical profession, and from a desire to comprehend the principles inculcated, which are of high importance. When he has made himself familiar with the principles here advanced, and the rules of practice laid down, and when he has compared them with the operations on the arteries since invented and performed, he will be prepared to determine whether or not there be something due to the memory of Mr. John Bell, more than has been acknowledged.]

artery has always been thought the most certain cause of it. Among the arteries which supply the upper and lower extremities, certain inosculating branches have become remarkable by their importance in disease; inosculations have been found (after the operation for aneurism) encircling the elbow joint, and supplying the place of the main artery; inosculations round the knee and ham have been sought for, and are presumed to exist; these inosculations have, of course, been particularly noticed, while it has escaped observation that inosculation is essential to the healthy constitution of all parts of the body; that the inosculation of arteries is not peculiar to any joint, limb, or organ of the body; that the inosculation of arteries is an essential provision of nature for the free circulation of the blood; that no part is without inosculations sufficient to support it against all obstructions.

The intestines, the solid viscera, the brain, the womb, have their arteries from a variety of sources; they have many great and separate trunks, but all their branches have frequent inosculations. In the extremities, the joints are surrounded in a particular manner with frequent inosculations; the obstruction of one artery never hinders the circulation of the blood, but according to the various postures of the body, according to the various fulness, distension, and contortion of the viscera, the blood enters by various channels, and moves at different times, in opposite directions, along the same artery. Why, for example, should there be so free an inosculation in the great epiploic arteries of the stomach, unless the blood moved occasionally from the left artery into the right, or from the right artery into the left? The womb has its four arteries, with free inosculations among their several branches, and is supplied with its blood sometimes from the arteries of the right side, sometimes through those of the left, according to its inclination during pregnancy; for very generally the fœtus is attached to one side, the womb rests obliquely upon the brim of the pelvis, one set of the uterine arteries is more particularly compressed, while the others convey the blood freely. The brain has its four arteries, and often the carotids have been obstructed, and the whole blood has run into the brain, through the vertebral arteries, and circulated backwards towards the face, throat, and jaws, by the inosculating branches. The thyroid gland has its four arteries, and when it is diseased, and when it has been tried to cut it out, the operator finds, to his great terror and embarrassment, the blood pouring, with equal violence, from every artery of the gland; and that while one inosculation is left, while one arterial mouth is open, it bleeds with more than the violence of a single artery, for it draws its blood from all those which inosculate with it. When our limbs rest upon one side, the blood runs in another direction: while we grasp, turn, bend, and exert the limbs in various ways, we are perpetually changing the direction of the blood: and though the communications of the arteries are less marked in other parts of the body than in the brain, womb, thyroid gland, and round the joints, we have reason to believe that such inosculations are universal; that they increase the force of the circulation, and are necessary to the free motion of the blood; that the blood often runs a retrograde course; that these frequent inosculations are essential to health, and competent to the supplying of the parts, in the accidents of wounds, obstruction, or disease*.

If surgery could continue to improve, and the books of the present day be altogether forgotten, it would not be easy to persuade a surgeon of the nineteenth century that amputation was at one time decisively recommended in all wounds of the great arteries, or that the most respectable writers, men old in practice, accustomed both to advise and to operate, oftentimes put up at the head of their most interesting chapter the following aphorism:—"When the brachial or femoral artery is wounded, though the patient should not perish by the hæmorrhagy, the limb must soon die for want of nourishment!" A surgeon is not only vexed with the difficulties of finding or tying a great artery, he is distracted with fears and doubts about its success. He is warned, "that in such case the progress towards putrefaction will be very swift."—"That a wound of this kind very generally requires amputation." All intermission is cut off; not one precious moment is to be wasted in delay; not a moment is allowed for thought; not the slightest doubt is suggested in so difficult a question. While this rule remains unrefuted (a rule which no sensible man will conform to), the young surgeon is left in a distressing situation; he hears, indeed, reports of limbs being saved, but no otherwise than by miracle; he knows that the general rule of surgery is to cut them off! Naturally unwilling to perform such an operation, he shrinks from it, he performs rather the operation for aneurism; but every time he performs it, he feels himself particularly responsible! he feels himself answerable for his patient's life every time that he refuses to comply with the common rule of amputating his limb.

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* I have seen from some natural cause the artery of the arm obstructed, from the bending of the arm to some point beyond the wrist; but the artery was cut out by a rude dissector, and no conclusion could be formed from this singular and interesting fact.

There are innumerable accidents, as bruises, compound fractures, and gun-shot wounds, in which the limb is so hurt, that, if along with these injuries the great artery be wounded (driving its blood deep among the disordered parts), there is every danger that gangrene will ensue, but not from want of blood! we find inosculations formed among the first branches of the great arterial trunks the moment they have emerged from the trunk of the body, such inosculations as should preserve the whole circulating system, even although the aorta itself were interrupted! I know of no part of the body in which the simple wound or interruption of the artery, uncombined with other injuries, should prove fatal; I would tie the artery of the groin or axilla as confidently as I would tie the artery in the ham, or at the bend of the arm: and I hope to set up at the end of this discourse an axiom, the reverse of that which I have just mentioned; for I will endeavour to establish my conclusion on substantial proofs; while the old doctrine is, I assure you, founded on mere prejudice and groundless fear.

When I cast my eye over the general plan of the arterial system, I think I can mark out three chief points, where, by observing the connexions of the arteries, we shall be able to lay sure grounds for very important conclusions. First, I am ready to prove to you, that no sooner do the two great arteries of the axilla and of the groin emerge from the trunk of the body, than they establish sufficient connexions with each other (distant as they are) to ensure the continuance of life even though the aorta itself should be interrupted. Secondly, That the two great fleshy joints of the haunch and shoulder are so surrounded with copious inosculations as to ensure the life of the extremities, though their arterial trunks were interrupted! And, Thirdly, That the inosculating arteries surrounding the smaller joints of the knee and elbow, are neither more conspicuous nor more effectual in preserving the circulation than those of the shoulder and haunch, though the surgeon has a perfect dependence on the one, and has as yet scarcely learnt the importance of the other. You are, I doubt not, prepared to follow me in this investigation, with a degree of interest fully equal to the tediousness of the inquiry.

First, When the two great arteries of the arm and of the leg emerge from the trunk of the body, they send out each a very remarkable branch! From the subclavian artery goes off the internal mammary, which runs along through the thorax under the sternum, down to the scrobiculus cordis. The femoral artery, in like manner, sends off the epigastric artery, which turns backwards under the femoral ligament, runs along under the rectus muscle, rises to the scrobiculus cordis, and there terminates in inosculations, with the mammary artery, forming a connexion betwixt the two arterial trunks, which has been long remarked. This inosculation, I shall presently prove to you, is sufficient, when the aorta itself is interrupted, to supply the great artery of the thigh with blood.

Secondly, The subclavian artery, just where it turns over the thorax, sends off several very remarkable branches. The branches of the thyroid and cervical arteries, long, slender, and considerable in respect of number, turn round the shoulder joint, and mix their extreme branches with those branches which come off from the brachial artery; and one branch is of remarkable size, the supra scapularis, which turns over the shoulder, enters the notch on the upper border of the scapula, and supplies much of the flesh which covers the scapula; it inosculates, in a particular manner, with the subscapular artery. You have but to tie the axillary artery, and inject wax by the subclavian from within the thorax, you will find your wax run freely into the lower part of the brachial artery, and will be satisfied that those inosculations are competent to the support of the limb.

In like manner is the haunch surrounded with many arteries, which hold remarkable inosculations with the arteries of the thigh. They all turn round the pelvis, just as the cervical and humeral arteries turn round the scapula; they all inosculate with the profunda femoris, as the supra scapular branches inosculate with those of the humeral artery; the Ischiadic artery comes out through the Sciatic notch along with the sciatic nerve; the Thyroid artery comes out through the thyroid hole with the Thyroid nerve; the Pudic artery comes out by the side of the bladder to supply the parts of generation. All these branches have frequent inosculations with the two uppermost branches of the profunda, i. e. with the inner and outer articular arteries which surround the hip joint; and these inosculations are either so frequent, or so wide, that they convey an injection easily; if you tie the External Iliac artery, and inject from the Common Iliac, you will find your injection in the femoral artery, although the direct road to it be obstructed by the ligature. It is almost sufficient that I affirm that those inosculations permit an injected fluid to pass through the limb directly, and at one stroke of the syringe, without that slow insinuation of the blood, and dilatation of the arteries, which facilitates the effect in the living body; but I will moreover prove to you, by the most direct inference, that these inosculations are sufficient to save the limb even when the great artery is tied close to the arm-pit or groin, when the femoral artery itself is obliterated within the pelvis by disease, and the whole limb disordered by the extravasation of blood.

Thirdly, Round the joints of the elbow and knee there are well known inosculations, which have attracted particular notice, because of the frequency of aneurism in those two points of the arterial system. As the brachial artery advances towards the bend of the arm it gives off three arteries, the Profunda

Superior, the Profunda Inferior, and the Ramus Anastomoticus Major. These three arteries, lying parallel with the main artery, are often named collateral arteries; they are very delicate and slender; they twine round the elbow joint, and they inosculate with three small arteries, which are reflected from the three great branches of the fore-arm. These retrograde twigs are very small; they are named Recurrens Radialis, Recurrens Ulnaris, and Recurrens Interossea: the whole apparatus of inosculating arteries consists of the most delicate and almost invisible twigs; it is indeed a fortunate injection that shows the communications of those twigs with each other. The elbow joint is naked and bony; the vessels delicate, long, and slender; the injection does not pass through those inosculations so freely as it does round the inosculations of the fleshier joint of the shoulder; these vessels will hardly transmit tepid water, and yet they enlarge so easily, that the main artery may be tied with perfect confidence. The operation for aneurism has been performed some hundreds of times; and, notwithstanding the apprehensions of surgeons, never has a gangrene occurred from such a cause.

In like manner is the knee joint surrounded with inosculating arteries. The popliteal artery, as it approaches the bending of the ham, gives off branches exactly resembling those of the Humeral artery, and they are met by branches returning from the three great arteries of the leg, viz. from the Anterior tibial, the Posterior tibial, and the Fibular arteries. These also are long, slender, delicate arteries, injections penetrate them with difficulty, the artery in the ham being tied, the tibial arteries do not receive an injection thrown into the arteries of the thigh, and yet the articular arteries have so often saved the limb after the operation for aneurism in the ham, that when the operation fails, the mortification of the limb is to be attributed to causes very different from the want of blood.

The inosculations of all kinds of vessels are innumerable and perpetual, but in a practical review of the arterial inosculations, these three are the chief: First, The inosculations of the axillary and femoral arteries through the epigastric and mammary arteries. Secondly, The inosculations surrounding the fleshy joints of the Shoulder and Hip, viz. the Cervical and the Sciatic arteries; and, Thirdly, The slender inosculations which surround the naked joints of the elbow and knee, called the Articular or Inosculating arteries: I trust I shall be able to prove, that each of these has a degree of importance which has not hitherto been attached to it.

FIRST, OF THE INOSCULATIONS WHICH SUPPLY THE PLACE OF THE AORTA.

The first vascular connexion which falls to be illustrated is that of the axillary artery, with the arteries of the thigh: perhaps there are no two arteries of the body so far removed, and yet so immediately connected with each other. There is no inosculation more incapable of dilatation, nor more circuitous than this; and there is nothing in pathology more difficult to believe, than that the blood should pass by this rout from the subclavian to the femoral artery, or that two small arteries, the mammaries and epigastric arteries should supply, in any degree, the want of the aorta, yet the fact is proved. "Mr. Paris, dissector for the amphitheatre of the Hotel Dieu, in the year 1789, injected the body of a very lean old woman, of about fifty years of age, whose arterial system was found to be singularly deranged, and the circle of the blood changed altogether, by a complete contraction of the aorta a little beyond the arch; and Mr. Paris had his attention particularly excited to the condition of this subject by the unaccountable enlargement of the small arteries upon the fore part of the chest. He had filled the arteries with an injection composed of equal parts of suet and rosin, coloured with lamp black; and this injection, thrown in from the mouth of the aorta, passed along so easily, that far from suspecting any obstruction, he felt that he could have thrown in more injection than is usually required for filling an adult body.

"The subject was so meagre, that, without dissecting, Mr. Paris felt the thoracic arteries running down the sides of the chest, tortuous, and remarkably enlarged. It was natural for him to be very careful in the dissection of this subject. He found the aorta, immediately beyond its arch, contracted to the size of a writing quill! The coats of the artery were of their usual thickness, and its cavity of course extremely small; the arch of the aorta above this constriction was but very slightly dilated, the part below had lost nothing of its natural size. Nothing could be found, either in its own structure, or in the condition of the neighbouring parts, to account for this constriction of the artery.

"The carotids were natural. The arteria innominata and the left subclavian were enlarged to twice their natural diameter; and all their smaller branches had increased in the same proportion, and had assumed a curled and zig-zag course. The internal mammary and phrenic arteries were greatly enlarged and very tortuous. The transverse arteries of the neck were of twice their natural size. Their posterior branches were tortuous, extending to a great distance over the back, with long inosculations, which were met from below by the branches of the Upper Intercostal arteries, and they were also remarkably enlarged; the thoracic and scapular arteries, which go along the sides of the chest, were of twice their natural size.

"Below the constricted part of the aorta, the Lower Intercostals were remarkably enlarged, even to three or four times their natural size; each of them was dilated, but those were most affected which came off highest and nearest the contracted part, and the posterior branch of each, which penetrates to the muscles of the back, was more dilated than that which runs betwixt the ribs: indeed, those posterior branches were so remarkably dilated with contortions so closely succeeding each other, that they resembled a necklace of beads; and their inosculations with the branches of the Transversalis Cervicis were very remarkable. The Lower Phrenic artery was enlarged, holding considerable inosculations with the superior phrenic; and the Epigastric artery was dilated to the size of the enlarged mammary artery, and was joined with it by very numerous and very conspicuous inosculations *."

The import of this very remarkable dissection you cannot fail to perceive, and I dare say you have been employed in remarking, while I described these dilated branches, the several inosculations, and in matching branch with branch among those enlarged arteries. I need not enter into any minute analysis of this phenomenon, but some conclusions which the author has neglected I will venture to supply. By this constriction of the aorta, it was divided into two portions, and all its lower parts were deprived of blood. The carotids were not dilated, because they pass on directly to the head, and give no branches which could inosculate with branches from the lower part of this obstructed aorta. The subclavian arteries were remarkably enlarged, because the whole circulation of the body was to depend upon their smallest branches: these small branches were, by their dilation, and by their number, to compensate for the want of any more direct communications betwixt the upper and the lower parts of the aorta! for of the lower aorta, the whole wanted blood from the top of the thorax downwards all through the abdomen; the lower extremities also wanted blood. This blood then was supplied from other sources: it was delivered into the aorta at two points, one set of inosculating

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* Vide Dessault's Journal de Chirurgie, Tom. II. p. 108.

arteries opened into the thoracic aorta, and supplied blood for the abdomen, while another set opened into the iliac or femoral artery, and supplied blood to the lower extremities. First, The arteries passing off from the subclavian round the back and shoulders, i. e. the transverse arteries of the neck, and the transverse artery of the shoulder, were of twice their natural size; they extended over the back, and ended in long and tortuous inosculations with the posterior branches of the intercostal arteries, which were dilated and twisted so as to resemble a string of beads; and the upper intercostal, which comes off from the subclavian artery, within the chest, being enlarged, and inosculating with the lower intercostal arteries which come off from the aorta below the third rib (and below the constriction), assisted in filling the great trunk of the aorta with blood; which also received some from the enlargement and mutual inosculations of the upper and lower diaphragmatic arteries.

The artery of the thigh, on the other hand, was filled with blood, which passed from the subclavian along the internal mammary artery; this internal mammary was reinforced by inosculations with the thoracic or external mammary arteries, while the blood of both mammary arteries poured into the femoral artery through the Epigastric. The blood in most parts of the body was retrograde; the smallest arteries of the body, the most slender, those of the most delicate inosculations, were made to stand in place of the aorta itself. The blood reached the trunk of the aorta through long and small arteries, twining in a tortuous form round the back and shoulders! The blood of the femoral artery reached it from the subclavian, by the long and slender inosculations of the mammary and epigastric, running directly down the fore part of the belly. "The part of the aorta immediately above the constriction was scarcely dilated. The part below had lost nothing of its natural size." The pressure then had fallen very light upon the constricted part of the aorta, no dilatation, nor the slightest appearance of aneurism, had been produced by the action and pressure of the heart, forcing the blood through this stricture, none but the smallest arteries, those farthest removed from the force of the heart, had dilated, rather by the demand of blood upon them, and by their own increased action, than by the vis a tergo. It would thus appear that the stroke of the heart is not essential to the reaction of the arterial system! That if arteries be but filled, they will be excited, and will, by their own muscular power, propel their blood.

Nor need we wonder at this complete obliteration of the canal of the aorta; it is not without a parallel in the other important vessels of the body; those even on which life and nourishment most immediately depend. My friend, Dr. Baillie, found the Vena Cava obliterated from the kidney to the diaphragm; it was closed at that very place where it should immediately discharge the whole congregated blood of the lower extremities and pelvis into the heart. So entirely was the cava obstructed that air could not pass. The blood went by a very circuitous route; the emulgent vein was dilated; the small lumbar veins were enlarged; the thoracic veins, and especially the vena azygos, were distended so as to receive all the blood of the lower cava. That blood which should have passed in under the liver, ascended to the subclavian vein; and the lower cava was represented by the small thoracic veins and vena azygos, just as the aorta, in the case I have now related, was represented by the small intercostal arteries.

The Thoracic Duct itself is often obliterated; the main duct is obstructed by tumors of the absorbent glands, or diseases of its valves; the adjoining absorbents dilate, so as to represent the proper thoracic duct; and indeed the long absorbent, which, running along by the left side of the aorta, carries, in such cases, all the absorbed fluids, is so peculiar in its form, place, and circumstances *, that I am almost persuaded the thoracic duct is double! that the absorbents of the loins, by which we inject, lead more directly to the greater branch of the duct on the right side, is the reason why it alone is known as the channel by which the chyle and lymph are carried into the circulating system, while obstruction from disease, or the application (while we are throwing in

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* Mr. Astley Cooper has published, in the Medical Records of London, a very neat, short, and well composed paper, on the obstruction of the thoracic duct, accompanied with a drawing, and with many very ingenious observations, which lead me strongly to suspect that this long lymphatic is more important than is imagined; that the thoracic duct is absolutely double.

But Mr. Cooper, now Sir Astley Cooper, has done a great deal more: he has, since the publication of these remarks on the inosculations of the aorta, tied that artery in the living body. Most surgeons, however, have rejected that operation, as going a little too far, and as conveying a notion more of boldness and readiness than of proper discretion. When my brother argued for the freedom of inosculation, even when the aorta was obstructed, he meant only to infer, that if the inosculations were sufficient for supplying the place of the aorta, then might we depend on the inosculations of all other arterial trunks.

the injection) of a ligature round the root of the great thoracic duct, is necessary to point out to us the branch which lies along the left side of the aorta.

We perceive, then, that there are formed, even in the trunks of these great vessels, such inosculations as ensure the continuance of life, when the Thoracic Duct, the Vena Cava, the Aorta itself, are stopped up. Nature, even in these desperate emergencies, has provided against that gangrene, and death, which narrow sighted physiologists have ventured to prognosticate, where only the lesser arteries of the limbs are interrupted. We can have no doubt of the perfect power of the inosculating vessels in all other parts of the body, but we take particular pleasure in investigating the effect of the inosculations which surround the great joints of the shoulder and haunch, because the investigation is itself one continued review of many important cures and operations, and each conclusion is of the highest importance in practical surgery.

SECONDLY, OF THE INOSCULATIONS WHICH SUPPLY THE PLACE OF THE FEMORAL ARTERY.

Surgery and anatomy, which should go hand in hand, have not only been seldom combined, but have actually been the separate studies of two distinct sets of men. Physicians, and professed anatomists, have written in their closets, conjectures and cautions, and schemes of operations, while surgeons, far from being able to compare those conjectures with the truth of their own art, have humbly received them as absolute rules. Unless from mere caprice, or the hopes of saying something ingenious, physicians have been at little pains to study the common operations. But when a question presents itself of such high importance as this, "What are the branches which save the limb when its main artery is tied?" We should hope to find a point so easy of solution, very early studied and explained, and yet no one artery has been thoroughly studied, nor has any one set of inosculating arteries been truly investigated! The greatest anatomists have written on these subjects with unaccountable indifference and carelessness: they knew not that the femoral artery divided in the middle of the thigh: they knew the arteria profunda femoris only as an accidental artery: they described it as a lusus naturæ, and made their experiments and dissections, not on the bodies of men, but on horses and dogs!

The celebrated Vesalius hardly knew the profunda; we see it indeed in his plate; but we observe it only because we know the artery, and the importance which it now has in the eye of the modern surgeon; for though it is marked (χ. ψ.), and is represented in his plate inosculating slightly with the arteries of the pelvis, it is not drawn truly, nor well explained *. This plan or drawing of Vesalius, though more elegantly engraved, is less true and accurate than that of Eustachius; for in the Tabula XV. of Eustachius we find the profunda distinctly marked, but yet it is not characterized with any of those inosculations which give it its chief importance in the eye of the

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* Vesalius, however, observes, and marks one very large anastomosis of the profunda with the thyroid artery. Integra totius magnæ arteriæ delineatio.

surgeon; it is not even so fully drawn as to attract the notice of the careful Albinus, who, in his explanation of Eustachius's Tables, has passed over this artery in silence, while he should have marked T. fig. 15. as the great arteria and vena profunda femoris, going down together into the flesh of the thigh. In Verhein this great artery is represented in its true proportion to the arterial trunk; but it appears in his plan as one long and simple branch, not having that importance nor those wide inosculations which constitute its chief character.

Heister comes after all these anatomists, and being himself an anatomist and a practical surgeon, we should have expected from him better things. He blames all former authors, Verhein excepted, for having neglected this important branch, "which, after all, says he, is not so very rare." This one expression shows how poorly he understood what he ventured to criticise. He regards the artery always as a variety, as a mere accident: he compares this double artery of the thigh with the accidental division of the humeral artery above the bend of the arm; and that we may not mistake his illustration, he draws upon the same plate, with a wounded femoral artery, a high division of the arteries of the arm.

It may be said truly that all former authors knew this artery; Heister alone did not know it, nor had he at all profited by the discoveries of those whom he ventured to criticise. Vesalius, Eustachius, Verhein, Cowper, all drew this artery, some with more, and some with less accuracy; and their drawings being designed as general plans of the arterial system, it must be presumed that they regarded this as a constant and regular artery, while Heister alone speaks of it as an accidental artery! he mentions it as an accident peculiarly fortunate, when along with a wound of the main trunk there chances to be a double artery in the thigh. Yet Heister did not voluntarily take upon him to investigate this artery merely as a matter of speculation, the question was obtruded upon him as of the highest importance in practice. A shoemaker having dropped his paring knife from betwixt his teeth, clapped his knees together to catch it, and struck the point of the knife into the femoral artery. Heister resolutely undertook the cure by compression, neglecting the old rule of surgery, which directs that every limb wounded in its great artery should be cut off. He undertook the cure only upon the presumption that there might perhaps be in this man a double artery: he delivers his opinion of the case in these terms: "If there be only one arterial trunk in this thigh, as often happens, then neither compression, nor ligature, nor any thing but amputation, can save the patient's life; the limb usually falls into absolute gangrene." Heister resolved in this case, first, to try what could be done by compress and bandage, as if he had believed it possible to heal the artery; whereas, compression, whenever it suppresses bleeding, must do so by obliterating the cavity of the bleeding artery! Next he advises, if the compress do not suffice, to open up the wound, and tie the artery; and, as if the tying of the artery obliterated the trunk more fairly than the compress, he adds, "But if, having tied the artery, there should chance to be but one great trunk (Imo, si forte non nisi unicus arteriæ truncus adesset), the leg must be cut off, otherwise it will mortify, and the patient die."

Heister not only explains himself thus upon an occasion, in which he was particularly interested, in understanding the femoral artery thoroughly; but he adds to this practical caveat, and to his undigested criticisms of Vesalius, Eustachius, and Cowper, a history of the femoral artery, worse in all respects than that of any anatomist who had gone before him; for he says, "The crural or femoral artery most commonly descends through the whole thigh, quite to the knee, in one single trunk, sending out only very trifling branches to the great muscles of the thigh to nourish them:" "But nevertheless it does sometimes divide in the upper part of the thigh into two great arteries." That there might be one great trunk only was the chief apprehension of Heister, when in truth it would be as difficult to find a thigh wanting a profunda, as wanting a femoral artery.

But this mistake of Heister did not end with himself; there is another surgeon of the present day who is guilty of calling the profunda a lusus naturæ. Mr. Gooch mistakes this profunda, calls it an accidental branch, a lusus naturæ. He describes it as an accident similar to the high forking of the humeral artery; he does not indeed clench it with Heister's direct affirmation, "Scilicet sæpe observari solet;" but he writes a paper in the Philosophical Transactions, to inform the world of this interesting discovery, that he had three several times seen a double artery in the thigh. The terms in which Mr. Gooch describes this discovery, which he made while performing an amputation, and which he thought might turn out so interesting in consultations about aneurisms of the thigh, are these :—

"In this amputation we observed a division of the femoral artery into two trunks of equal size running parallel; and so near together as that we could conveniently include them in one ligature with the needle, avoiding the nerve, after raising them up with the dissecting forceps by a small portion of the connecting cellular membrane; and here we found no occasion to take up any other vessel." "This makes," says Mr. Gooch, "the third instance of this lusus naturæ which I have observed *."

His amputation was particular only in this, that he had cut the thigh higher than usual. "The two great trunks lying parallel, and equal in size to each other," were the femoral artery and the profunda, and where he tied in one great ligature, both the femoral artery and the profunda, there was no wonder that he found no other bleeding arteries. These are the only peculiarities that I can see in this amputation, and I dare say his other amputations were like this †. When such an author proceeds, in the next

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* Vide Philosophical Transactions, 1775.

† The celebrated Professor Murray says, "I never could find this same double artery in the thigh, which Gooch pretends to have found three times, and believes to occur very often." "Nec unquam mihi arteriam femoralem superficialem duplicam videre licuit, qualem celeber. Gooch se ter observasse contendit, &c." p. 44. No wonder that Murray never found any such thing, for Murray knew what the profunda was, and perhaps was not so well acquainted with the English language as to understand that Mr. Gooch was calling the arteria profunda, a lusus naturæ, a double femoral artery, &c. was looking out for it in horses and dogs. That Gooch did not know the profunda is plain from this, that he never once mentions it in his Surgery, nor in his Royal Society paper. Mr. Gooch's opinion, and indeed his experiments, are repeated in that edition of his Surgery, which was published in 1792.

part of his paper, to retail to us his experiments ("made with the help of a famous farrier") upon horses and dogs, it is very allowable to say, that such experiments were but a poor substitute for actual dissections of the human body. And when surgeons seven years ago could venture to tie the femoral artery supported by no better hopes than this, we (knowing the profunda, and all its connexions with other vessels) may be very bold in tying the artery freely, not only in the thigh, but even in the groin.

From this history then we may learn, that, till very lately, the lateral arteries of the ham were the only inosculating arteries known to the surgeon; they were remarkable by their enlargement in popliteal aneurism; they were obtruded, as it were, upon the notice of the surgeon, who knew of no inosculations any where higher in the limb. At last the profunda was remarked; how imperfectly it was understood, the foregoing history will explain, but inosculations were supposed to exist betwixt that artery and the artery of the ham; and upon this presumption merely, without any assurance of such inosculations, the surgeon ventured at last to tie the femoral artery in the middle of the thigh, but he would not for the world have ventured to tie it above that point where the profunda is given off! Will it be believed that men wounded in the upper part of the thigh, and borne off alive from the field of battle, have been suffered to bleed to death from the mere apprehension of gangrene! as if this formidable gangrene would not have been as sure a consequence of the artery being wounded, and pouring out blood, as of its being safely tied up! Better not reason at all than reason so imperfectly; better almost to be ignorant of anatomy than know so little; better trust to the mere impulse of humanity, which would prompt us to stop the effusion of blood, and to save the life in the first instance, let what would befal us afterwards.

I will now proceed to lay before you a true history of the femoral artery, such as will entitle me to that broad conclusion which I have claimed, viz. " That there is no part of the body which is not endowed with inosculations sufficient to save it from all danger of gangrene when the trunk of the artery is obstructed."

The great artery, the Aorta, descends along the spine, and near the top of the pelvis, forks into the two iliac arteries, which are destined for the lower extremities; and each of these common iliac arteries, having passed downwards into the pelvis, is again divided into two arteries, the internal iliac, or hypogastric artery, which distributes its branches to the contents of the pelvis (supplying also the great muscles of the hip, and the upper part of the thigh), and the external iliac, or great femoral artery, which runs down along the thigh.

The Internal Iliac, or, as it is often named, the Hypogastric Artery, gives branches to the rectum, vagina, and womb, and, in man, to the urinary bladder and prostate gland; it gives arteries to the bones of the pelvis itself, and most especially to the os sacrum; but its greatest branches are four muscular arteries which pass out through the several openings of the pelvis to the muscles of the hip, thigh, and pudenda. They turn round the os innominatum much in the same manner that those scapular arteries which nourish the flesh of the shoulder turn round the scapula. The Glutæal Artery, the largest, turns round the haunch bone backwards and upwards; it serves the glutæal muscles: the Ischiadic Artery turns round the os ischium, and its branches turn downwards towards the hip: the Thyroid Artery is one which passes directly forward through the thyroid hole in the fore part of the pelvis; it is smaller than these; but it plunges into the very centre (as we may express it) of the thigh; it runs in among the heads of the triceps, pectineus and rectus muscles; it is in the centre of the thickest and fleshiest part of the thigh; it is also close upon the joint of the thigh bone with the os innominatum: the Pudic Artery is the fourth; it is so named from its being appropriated to the parts of generation; its main branch goes to the root of the Penis, while its muscular and largest branches pass out by the side of the Bulb of the urethra, and scatter upon the perinæum, holding but a slight connexion with the arteries of the thigh. These are the chief branches of the Internal Iliac Artery; they entirely encircle the fleshy joint of the hip, and they form many and powerful inosculations with the upper arteries of the thigh.

The External Iliac, which divides from the hypogastric at the side of the os sacrum, turns along the side of the pelvis, and emerges from the belly by passing under the crural arch; it then sends the epigastric artery upwards along the muscles of the belly, and the Iliaca Reflexa, a small reflected artery, backwards along the border of the os ilium. The femoral artery then bends downwards from the groin along the inner side of the thigh, and near the groin at the top of the thigh, about five inches under the crural ligament, it divides into two great arteries, equal almost in size, the one appropriated to the thigh and the other destined for the leg. The artery which is destined for the leg passes almost superficially along the fore part of the thigh, while that branch which belongs to the thigh itself plunges immediately into the thick flesh of the thigh; it spreads its branches to the very centre of the thigh, whence it is named Profunda Femoris; it is appropriated to the great muscles of the thigh, whence it was known among the older anatomists by the name of Muscular Artery of the Thigh; in size it equals the trunk of the artery, and is more widely distributed than any other artery of the body. Its trunk, where it comes off from the femoral artery, is thick and short, and its branches spread upwards towards the hip joint, or downwards towards the back part of the thigh. Two large branches turn suddenly upwards, they surround the hip joint by twining round it in all directions, they are large at this root, but soon spread into innumerable small twigs, their inosculations with the arteries which come out from the pelvis are very frequent; these two branches, from their surrounding the inner and outer sides of the joint, are named the External and Internal Circumflex Arteries. The profunda, as it works its way downwards among the muscles of the thigh, divides (from step to step as it goes down from muscle to muscle) into three or four great branches; these pass through the triceps from the fore to the back part of the thigh, whence they are named the Four Perforating Arteries; and these in their turn inosculate downwards with the articular arteries of the knee joint.

The main trunk of the artery, that which is usually named the femoral artery, having sent off this great branch, which supplies the muscles, runs obliquely downwards along the inner side of the limb, superficial or almost so, lying only under the skin and the strong fascia of the thigh; it winds obliquely along the thigh in the exact course of the sartorius muscle; it penetrates about two-thirds down the thigh through the tendon of the Triceps muscle, and so passes from the fore part of the thigh into the cavity of the ham; it is simple, and unconnected with muscles; it gives no branches of any importance where it lies along the thigh; it sends off only small cutaneous and muscular twigs. When the femoral artery passes through the triceps, and arrives in the ham, it gives five long slender arteries to the knee joint; they are of the size of crows quills; they encircle the joint in every direction; three go off a little above the joint and three below, whence they are named the upper and lower articular arteries; they are named collateral arteries sometimes, and often inosculating arteries; they belong almost exclusively to the tendons, capsule, and bursæ of the joint, while some of their branches enter into its cavity to supply the ligaments and fat. But the femoral artery, unexhausted by these cutaneous twigs or articular branches, arrives at the top of the leg; lies close to the joint; attaches itself to the bones as if for support and safety; it divides a little below the gartering-places into three great branches, named tibial and fibular arteries; and these, like the radial, ulnar, and interrosseous arteries, run downwards along the bones.

These are the three arteries of the pelvis, of the thigh, and of the leg; and, when you cast your eye upon the plan, these things will strike you,—That the glutæal, sciadic, and pudic arteries, which surround the pelvis, and scatter such a profusion of branches in all directions, resemble those which surround the scapula. That the main artery of the limb, since it lies almost superficial along the fore part of the thigh, runs down unexhausted to the ham, and there divides into the three arteries which nourish the leg, should be named, not the femoral, but the crural artery; while the profunda, a deeper artery, since it goes solely to the muscles, is the proper artery of the thigh*. That this arteria profunda being as big as the femoral artery, having numerous branches, which run upwards towards the hip joint, and downwards towards the knee, must have large inosculations, whence we may be assured, that if it can draw blood from above it will easily transmit it to the lower parts of the limb; in short, that so great an artery must be quite competent to the nourishment of the thigh, although the main trunk were interrupted. The profunda lies as a great inosculating trunk betwixt the arteries of the pelvis and the arteries of the ham; its first branches turn upwards to meet those from within the pelvis, its lower branches turn downwards to meet the articular arteries of the knee: although it be the proper office of this great artery to nourish the thigh, yet one accidental, but very important office, is to inosculate with other arteries. It is thus by these conjoined offices that the economy of the limb is perfect; that it is nourished during health, and supported by new circles of blood when any accident affects the main artery.

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* Some confusion may arise from this use of terms; we call the artery as it comes out from under the poupart ligament, Crural Artery. The main artery which goes down to the leg is called the superficial femoral artery; the other the profunda.

This succession of inosculations all along the limb must appear very interesting to you; those which are formed in the ham by the articular arteries have been long remarked, because they are enlarged in popliteal aneurism and save the limb; yet they are in their natural state too delicate to receive injection, or to allow it to pass easily. Those which surround the hip joint, formed by the upper branches of the profunda with the arteries from within the pelvis, are more numerous, in proportion as the joint is fleshier and larger; they receive easily injections of wax, while we can hardly force water into those surrounding the knee; yet they have never been observed, nor has any surgeon ventured to tie the femoral artery above the profunda; as if the profunda were a particular vessel, appointed by nature in a certain part of the limb to facilitate the surgeon's operations when he chose to perform them!

The succession of inosculations is so perfect, that were the main artery obstructed even within the pelvis, or at the groin, innumerable branches of the sciatic and thyroid arteries would pour the blood through the upper branches of the profunda, and from the mouth of the profunda into the femoral artery! Were the femoral artery obstructed in the thigh, the trunk of the profunda would convey the blood freely, the numerous branches of the profunda would distribute that blood for the nourishment of the thigh; and some inosculating branches enlarging more than the others, would carry the blood round the obstructed part of the artery, and convey it with a full stream into the artery at the ham! Should both the profunda and the femoral artery be abridged, or obstructed, or quite destroyed, the long and slender branches of those arteries receiving the whole blood of their parent trunks, would enter into a powerful action, and dilate so as to convey the blood effectually along the back part of the limb from the hip to the ham! That such long and slender arteries should become effectual arterial trunks, should represent the main artery, and convey the whole blood of the limb, must seem incredible, till I shall have produced the proofs, every one of which is in itself important.

The theorem, then, which I have now to prove is this, that not the femoral artery only may be safely tied in the middle of the thigh, but that the femoral artery, the profunda, and even the iliac artery within the pelvis, may all be obliterated without the limb falling into gangrene. This must be established, not by alleging probable consequences, but by plain facts; and I enter the more willingly on this proof, because it includes, a fortiori, the true doctrine of wounds in all the lower parts of the limb.

"Guattani was called to a man of thirty years of age, who lay ill in bed with an aneurism of the groin, accompanied with fever, which proceeded merely from the excruciating pain. The tumor was close upon the fallopian ligament, hard, firm, of the size of a large quince, colourless, but with an intense pulsation; and the whole limb was distended almost to bursting."

"Guattani had expected to cure even this aneurism by gentle compression. He was indeed at one time flattered with hopes of success: the fever had subsided; the pain had ceased; there was a sensible lessening of the tumor, so that he found it necessary to draw his rollers closer from day to day; for a whole month did he indulge the hope of accomplishing the cure. But while the tumor seemed thus yielding to the compression, it burst during the night, with intense pain, and the attendants were obliged instantly to cut the bandages and give the patient relief. Then the blood rushing forwards among the cellular substance, which surrounds the psoas muscle, produced so sudden an enlargement of the tumor, that Guattani, at the next visit, perceived that all hopes of a cure were at an end; bandages could no longer be applied; no endeavours to appease the pain, or restrain the tumor, were of the smallest service; from day to day the tumor extended; it came plainly from within the pelvis; it filled the whole Hypochondrium, extended along the groin, and reached the middle of the thigh: with this prodigious tumor, hard, firm, pulsating strongly, and filling the haunch both within and without! the man lingered four weeks and then expired."

The conclusion which I am to draw from this interesting case is not undisputed. The celebrated Murray will not allow that the bursting of the artery implied a total change in the current of the blood. "Although," says Murray, "Guattani was able to push an injection of tepid water, tinged with yellow, from the glutæal artery round into the trunk of the femoral artery, yet do I suspect strongly, that the grosser fluid, the blood, would pass through the same channels more difficultly; nay, so sparingly as not to nourish the limb." But I will relieve you from all doubts by explaining the state of the parts. Twenty-four hours after death the body was dissected. Upon opening the abdomen, the coagulated blood was found to extend upwards along the whole bed of the psoas muscle, and downwards nearly to the middle of the thigh. This blood being removed, the iliac artery was found torn where it runs along the edge of the os innominatum. The laceration was four inches in length; was on that side of the artery which lies upon the os ilium; began about an inch below the giving off of the internal hypogastric artery, and terminated near the ligament of the groin. The blood had escaped from the back part of the artery, it had been injected under the back part of the muscles, and among the cellular substance, which belongs to the periosteum of the bones. The artery was raised up from its bed of cellular substance by this extravasation, and pressed strongly forwards, not only against the peritoneum, but against the muscles and skin, and was wonderfully flattened, so as to prevent its conveying any blood to the limb. The bones were carious and spinous; the capsule of the hip joint was destroyed; and the head of the thigh bone was entirely displaced.

This disorder and destruction of parts induced Guattani to investigate the whole course of the femoral artery, which he seems to have traced very carefully from the groin to the ham. He began his dissection where the laceration ended, viz. near the ligament of the thigh. He made from that point a longitudinal section of the artery, and found its calibre somewhat below its natural size, decreasing gradually as it proceeded down the thigh. Where the artery approached the ham he thought that it absolutely closed: but, upon examining carefully, he found it could still admit one of Anell's wires, though with difficulty. It enlarged again to its natural diameter when it had entered into the cavity of the ham.

The circumstances of this case and dissection are, I think, decisive of this important point. The artery thus constricted, straitened to such a degree that it could scarcely admit one of Anell's wires for searching the lachrymal ducts (a wire no bigger than a bristle), could surely transmit no blood, and was in no respect equal to the nourishment of the thigh. Had the continued trunk of the artery been capable of conveying blood, the bursting of the artery within the pelvis must have deprived it of all chance or possibility of receiving blood. Had this artery been entire in its upper part, and pervious below, so as to receive and transmit the blood easily, still it was in its middle so raised and stretched over the extravasated clots, as to prevent, to use Guattani's own words, one drop of blood passing along to the lower parts of the limb; not only the main artery was thus burst, distorted, and straitened, but all the collateral arteries must have been obliterated. The femoral artery seems to have escaped total erosion, because it was raised over the extravasated blood, and pressed close to the skin; but how could the profunda, the deep, muscular, and articular artery of the thigh escape, when the muscles themselves were disordered, the capsular ligament destroyed, the head of the thigh bone displaced, and all the bones carious? The injection of yellow water, of which Murray speaks slightingly as a doubtful experiment, is absolutely decisive; for though yellow water may be forced from the hypogastric artery, through the natural inosculations, into the femoral artery, yet it will not pass through two successive series of inosculating arteries. Where both the femoral artery in the groin, and the popliteal artery in the ham, are tied, tepid water, when injected, has to work its way through successive sets of inosculations, and exudes into the lower arteries very sparingly! But in this case, water thus injected flowed easily into the arteries below the ham, while we perceive, by the experiment which I have quoted below, with how much difficulty the injected water finds this passage in the natural state of the arteries, and how wide the difference is betwixt the condition of an aneurismal limb and of a sound one.

Murray's difficulties are answered in one word:—Not this yellow injection only, but the blood itself, actually moved through the inosculating arteries; the man lived several weeks after the artery had burst *!

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* Guattani does not mark the difference betwixt his experiment and his dissection; but his experiment was this: First, he placed his injecting tube above the hypogastric artery, then he tied the femoral artery in the groin, and threw in his injection, and it went round easily into the profunda femoris; which he explains by saying, "More satis copioso perfluxit." Next, he made another ligature upon the great artery in the ham, imitating the obstruction in this case of aneurism, and he forced the injection round in a second inosculating circle, viz. by the articular arteries of the knee, where, of course, the injection was a little retarded, but still flowed out, "liquorem sane effluere conspexi," but infinitely less easily, "sed longe lentius, parciusque."

This is the most singular fact in the whole pathology of aneurisms; for the blood which had nourished this limb had moved not only through the common inosculations round the hip joint, but it had gone by the most circuitous course. To finish its circle, the blood must have passed through three series of inosculating vessels, thus! the blood came not from the upper inosculations of the profunda into the trunk of the profunda, and so round the haunch, by a short circle, into the great artery of the thigh, but must have proceeded first through the sciatic, thyroid, and other arteries of the pelvis, into the articular arteries of the hip; then from the articular arteries of the hip into the profunda, which is their parent trunk; then it must have gone down from the main trunk of the profunda along those lower branches of the profunda, which are named its perforating arteries; then, from these, the lower extremities of the profunda, it had passed into the articular arteries of the knee, and by this last inosculation the blood once more had access to the trunk, viz. to the popliteal artery, where it divides into the three arteries for the leg. In short, it had happened in this case, as must always happen in such cases, that the smaller arteries of the whole thigh were remarkably enlarged; and that especially the arteries which pass round the hip were both so much increased in size as to be able to carry along a sufficient quantity of blood for nourishing the thigh; and that their inosculating extremities also were enlarged in like proportion, so as to transmit a sufficient quantity of blood for nourishing the leg. The blood had passed along by those vessels which lie upon the back part of the thigh, leaving the proper femoral artery dry of blood, and almost closed all the way from the groin, or rather from within the pelvis, down to the ham. I call upon Murray, with all his knowledge of the blood-vessels (and no other man knows so much about them), to point out any other passage for that blood by which the limb continued to live.

It is not from the want of every other kind of proof that I here press the argument so strongly. I do so only that I may impress it upon your minds, while I have many cases in reserve, more decisive perhaps than this. In that case which I lately mentioned, where a shoemaker having dropped his paring knife, struck it with the one knee against the other, so as to drive the point fairly into the femoral artery, Heister performed the cure, not by ligature but by compression. He laid a long train of compresses over the whole course of the femoral artery, from the wounded part up to the groin. Now, when Heister bound those compresses with the tightest rollers, drawn with all his strength! when he continued for three weeks a compression which commanded the hæmorrhagy, and stopped the motion of the femoral artery, what did he do? Is it to be believed that those firm compresses merely suppressed the more violent action of the artery, and kept its wounded lips in contact with each other till they adhered and healed? Surely not! He kept not the lips only of the wounded artery, but its sides, in perfect contact. When he thus closed the canal of the artery, the force of the circulation would fall upon the inosculating arteries. They would soon enlarge to such a size as to carry freely all the necessary blood. The circulating blood would no longer seek the main artery, which, being a contractile artery, would close in all its extent, and would adhere at all those points where it was particularly compressed. Heister's cure by compression would resemble in all essential points the cure by ligature; in this only it would differ, that besides being tedious, painful, uncertain, the cure by compression would obliterate both trunk and branch; for since the profunda lies directly behind the femoral artery, betwixt the compress and the bone (against which the artery is compressed), the compresses would obliterate the profunda, as well as the femoral artery, leaving nothing to support the limb but that series of inosculating arteries running along the back part of the thigh, the value of which I have just explained. In short, the profunda lying so directly behind the femoral artery, as to be taken up by Gooch in the same ligature, may very reasonably be supposed to be affected by the broad compress which, in this case of Heister's, covered the whole tract of the femoral artery.

But there is also another phenomenon in diseases of the femoral arteries which is very interesting, and which proves this point completely; for independently of operations by ligature or compression, we have evidence in the natural cures (as sometimes nature herself performs the cure), that the profunda may be cut off, together with the femoral artery, and yet the limb may be preserved. We see, for example, a great aneurismal tumor of the groin increasing rapidly till the skin threaten to fall into gangrene, and we wait in great anxiety and fear for that last change, in which the skin is to burst, and the patient to expire with one sudden gush of blood. The fever begins, the pulsation of the tumor ceases, the skin becomes livid, the whole limb is cold and without pulse, every thing seems to foretel an instant gangrene. But these, which are so often the mortal signs of gangrene in the whole limb, are sometimes rather the presages of a happy cure; for either the clotted blood has so accumulated as to press aside the main trunk, or (in the natural aneurism) the looser coagula have so fallen down from the walls of the aneurismal bag into the main channel of the artery, as to stop the circulation from the groin downwards, in both the profunda and the femoral artery. Such obstructions turn aside the current of the circulation, new channels are found for the blood, and as it begins to flow more freely in these, the pulse, the heat, the feeling of the limb, are all gradually restored, they are perfect in a few days; the patient awakens from the low delirium which accompanied the first alarming signs; not only his life is safe, but in a little while his limb also is perfectly restored.

Nay, it has really happened, that very nearly the same process has performed the cure, with this surprising variety, that during this natural cure, the tumor bursting, has laid the limb so open, that the surgeon has (if we may be allowed the expression) been able to look into the limb, and see how its vessels were affected.

Petrus Antonius Ferrari, a cook, a man of about forty years of age, died of a very singular aneurism of the thigh. His body was dissected by Petro Javina, a celebrated surgeon in Rome. The history of his disease is as follows: "When I first saw him," says

Javina, " on the 11th of October, he appeared of an unhealthy habit of body, and was laid in the hospital of the Holy Ghost, with a true aneurism of the groin, as big as the fist. It had begun about three weeks before, and was now greatly extended, both upwards towards the belly, and downwards towards the hip. The tumor was circumscribed, beating violently, and very painful, especially during the night; and finding that it had arisen from no external cause, I ascribed it," says Javina, " to the venereal disease, of which I observed many scars.

" Having bled the patient, and applied a sponge soaked in cold solution, the pain was slightly abated, but soon returned with a strong pulsation in the tumor. The tumor increased daily in magnitude; the pain, notwithstanding, and the pulsation, became slighter; and on the 19th of October, the pain and pulsation suddenly and entirely ceased, with a sense of bursting within, a sudden flattening of the tumor, and an extension of it half way down the hip." Thus is the day and hour of the bursting of this aneurism correctly marked, and the consequences of that bursting are next to be observed. " The œdema, which had hitherto been limited to the foot, now spread so rapidly, and with such entire loss of heat, feeling, and motion in the whole limb, as plainly to indicate approaching gangrene."—" But by the continual and careful application of cloths soaked in camphorated spirits, the limb was, in the course of forty hours, almost entirely recovered from this condition, with a manifest reduction of the œdema."—" Meanwhile the tumor rose higher and higher, with a livid and gangrenous bulging, which burst at day-break on the morning of the 31st of October." In the morning, Javina found his patient swimming in fœtid ichor. He immediately cut away the bandages, which had for eight days been applied by way of precaution, lest the patient should die of hæmorrhagy from the bursting of the weakened integuments. There was discharged from this crater a profusion of black and fœtid blood, partly grumous, partly dissolved into a fœtid serum; but of fresh and florid blood, which I greatly feared," says Javina, "not one drop flowed."

"He then cleaned the patient of this filth, filled the basin of the aneurism with the softest lint, rolled the limb gently with a bandage, which was renewed every second day; covered the whole with pledgits wrung out of a cold solution, and suffered the dressings to remain for eight days till they loosened of their own accord, the muscles, nerves, and arteries, and the skin itself, having run into absolute gangrene from the groin to the middle of the hip."—"Then were seen the pectineus, the iliacus, the lower part of the psoas, the sartorius, and the fore part of the triceps, cleared of the sloughs, red and granulating, and forming an empty space, a sort of triangular cavity, extending from the femoral ligament to the crossing of the triceps and sartorius muscles, where the femoral artery perforates the thigh; the crural nerves and vessels, which should have occupied the hollow, being entirely destroyed by the gangrene.

"It was necessary to empty the internal abscess of that fœtid ichor, which was continually draining down upon the sore; I passed my fore-finger," says Javina, "under the ligament of the thigh, which was then open, and, by the guidance of my finger, I cut the ligament, the abdominal muscles, and the skin itself, with an incision of no small extent; and thus having opened the deepest part of the sac, cleared it of the thick and foul matter, and dressed it with fine lint. The cicatrix advanced most prosperously on all sides with every prospect of recovery; but, notwithstanding my utmost care with soups, and every thing nourishing to support the patient's strength, he sunk daily, and died on the 27th of November.

"Upon opening the abdomen, every thing was sound there except an enlargement and hardness of some of the mesenteric glands." But when the common iliac artery was dissected from the peritoneum which covers it, and slit open down to its division into the external and internal iliac arteries, the internal iliac, or hypogastric artery, was found pervious, while the external iliac was found closed with a plug of coagulated lymph, very hard and firm, of a conical form, and half an inch in length; the plug had been moulded into this conical form by the mouth of the artery; the plug being withdrawn, and the probe introduced, the artery was found to be almost entirely closed."—"The sac of this aneurism was formed by the peritoneum, which was torn from the face of the internal iliac and psoas muscles, by the ruptured artery driving its blood into the cellular substance of that membrane."—"The dissection of the skin, muscles, and of this aneurismal sac, being continued downwards, and the artery cut across about two inches below the point of this plug, it was found enlarged to four times its natural diameter, of an oval figure, hard as a ligament, impervious, and terminated at its lower end in rags and fringes of the aneurismal sac."—" This oval part of the artery was so choked with a sort of polypous substance of various consistence, that the arterial coats were confounded and destroyed, the whole being converted into a mass resembling a sponge dipped in wax."—" The bones of the pelvis, too, where the iliac artery turns over the groin, and comes out into the thigh, and especially in the groin where the aneurism began, were thoroughly carious and black."—" The lower end of the femoral artery was closed (without any plug of blood) by a fringed extremity of the sartorius muscle, to which it adhered slightly."

I could not, without this detail of all the circumstances, venture to reason upon the case. We perceive, that in such aneurisms the force of pulsation becomes irresistible in the progress of the disease; if the aneurism burst before the arteries are all obliterated, the patient dies, in a few pulsations of the heart, so profuse and sudden is the loss of blood; but, if he escape this first danger, he may, though the arteries are obliterated, survive even for months (for this patient lay three months in the Hospital) and yet in the end die exhausted. The progress of this extraordinary aneurism is so distinctly marked from stage to stage, that we cannot but take a lively interest in the case. First, The aneurism burst; the blood was diffused among the cellular substance; the tumor flattened; the pain of distention ceased; the blood was no longer conveyed along the artery; the limb became cold, benumbed, motionless; and thus the patient lay for forty hours betwixt life and death. Secondly, The artery was at this time completely obstructed, and the limb turgid, and in imminent danger of gangrane; but the heat and feeling of the limb returned, and the lessening of the swelling showed that the vessels had renewed their action, and that nature had found out new channels for the blood.

Thirdly, The bursting of the tumor was not owing to the increasing impulse of the blood, for the artery had ceased to convey blood, its canal was obliterated; but the cellular substance was crammed with extravasated blood, the fore part of the limb was without circulation, the skin distended to actual gangrene, the tumor burst in consequence of that gangrenous suppuration which is inseparable from this degree of distention, and when it burst, the old and coagulated blood, or putrid serum, showed the condition of the parts; not one drop of blood flowed, which proved the obliteration of the great arteries on the fore part of the limb. Javina feared this period, viz. the bursting of the tumor, he seems to have been for some time in fear of the artery throwing out its blood; but had he observed the coldness, the numbness, and the loss of pulsation which must have accompanied this state of the limb, he might have suspected the total obliteration of all its great arteries.

Fourthly, This conclusion is common to Javina's case, and to other great aneurisms, that while an aneurism increases in size it becomes irresistible, and the parts cannot long endure the violence of its pulsation. But pressure and resistance are mutual! the skin cannot be affected outwardly without the parts within being destroyed; what destroys the muscles will destroy the arteries; and thus the pressure within may be such as to obliterate the artery before the bursting of the skin. If the aneurismal sac burst within before the external parts give way, the safety of the limb is almost ensured, for no blood moves along that artery; every thing is prepared for the final change; the blood finds new channels the moment the aneurism bursts, and the limb is absolutely safe; we have only to cleanse the sac, to support the strength, and to save the patient from the profuse evacuations necessarily flowing from this extensive gangrenous sac.

Fifthly, The main proposition which I meant to establish is here fully proved; there is no want of injections of yellow water to explain what had happened in this case. The aneurismal sac burst only after the obliteration of the arteries; then the skin gave way; the parts which had been injected with extravasated blood fell successively into gangrene; the sac cleansed and suppurated; the sartorius, pectinalis, psoas, and triceps muscles, were freed from their sloughs, and assumed a florid and healthy hue; the bed of cellular substance, in which lie the great vessels and nerves, was quite empty, from the ligament of the groin where the artery first enters the thigh, down to the tendon of the triceps, where the same artery passes into the ham. The cellular substance, arteries, veins, and nerves, were quite destroyed: The emptiness of this triangular hollow demonstrates, that all the great vessels were obliterated: The red granulated flourishing condition of the whole wound shows, that the limb was effectually supported by other arteries.

This case domonstrates that the great arteries of the thigh itself may be destroyed, not only without that gangrene which timid surgeons have foretold, but with such vigorous circulation remaining in the limb, as to enable the ulcer to throw off its sloughs like a gun-shot wound, and assume a healthy and granulating appearance, to heal rapidly, though too slowly (as in this case), for the patient's exhausted strength.

Morgagni* puts the following question, " How, after that remarkable cure by Marcus Aurelius Severinus, could the crural artery, when putrified, dissolved, and broken down near to the groin; how could it, by the force of fire applied thereto, so recover its parietes, that the limb not only continued to live, but the man could even walk upright upon it with the small support of a low and slender cane?" This question is already resolved: The artery did not recover its parietes, nor revive after being putrified and dissolved! but the branches of the profunda, which lie along the back part of the limb, were enlarged, and substituted in its place. I will relate the case to you with all those circumstances which seemed so wonderful to Severinus himself, and so inexplicable to Morgagni, but which you will easily understand: you will find in the following narrative old manners and antique surgery, but a case in all respects interesting and well related.

" I was called (says Severinus) to R. D. Anselmus Paganus, a nobleman, who had a tumor in the upper part of his thigh near the groin: he had been attended during four months by many physicians; the case growing daily worse, for the tumor, at first no bigger than a filbert, beating strongly so as to move the bedclothes, grew to such a size, that it lost its pulsation, and waxed as large as a winter gourd, with an unequal surface, marked with three prominent bumps."

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* Vide Alexander's Morgagni, p. 42.

"When the tumor was advancing towards its last stage, the pulsation was not only manifest to the hand, but was perceptible to the eye; it was not a partial nor slight pulsation, but a big throbbing of the whole tumor; it was terrible to the patient, who felt at each pulsation like the grating of a saw cutting and tearing across the nerves and tendons. His attendants feared lest he should expire under the tortures of this pulsating pain. He had the Hippocratic face, the attendants were watching his expiring breath, and the priests and the pious friends were speaking to him of the life to come. Night and day the bedclothes were raised by the strong pulsations of the tumor, as if by the thumping of a hand. The physicians of the city all were at a loss, some prescribing one thing, some another. One ordered compresses with plates of lead; another, a consecrated plaster; another, astringent embrocations: One ordered the application of a ram's hide, and such things as were commonly esteemed useful in hernia: another ordered the application of snow and ice; but one and all of them betook themselves away as they conveniently could: One sneaked off, another could not stay: another was in haste: one scarcely staid to hear the story with decency, while another prognosticated immediate death: some retired impressed with the horrors of the man's situation, and not indifferent to their own character: most of them gave him over to the upholsterers and sextons: one celebrated physician, very celebrated when called to prescribe, prescribed only extreme unction." By this part of the narrative, Severinus designed to show to what a dangerous condition this poor man had arrived, and how wrong it is to pronounce a harsh sentence, even in the most desperate cases. Here he describes the scene which had passed before he was called; but the condition of the patient when he first visited him was as follows: "He found the tumor running rapidly into gangrene, livid, covered with vesications, and the livor extended to the toe. The limb was quite insensible; he had wakeful nights, and horrid dreams; the eyes were, as in a coma, heavy and loaded; he had continual fever, with turbid urine; delirium at times, and great failing of strength; the limb lay out motionless, but with terrible pain of the knee, shin, and foot; he could not move it, and cried continually to his friends to change the posture of the leg, which gave him some slight relief."

Severinus having exonerated himself by giving the prognostic natural in such a case, applied an astringent in place of a relaxing poultice, and matters seem from this period to have taken a very sudden and happy turn; for in a very short time the livor of the tumor disappeared, a small part only in the centre of it remained insensible, and by the operation of a powerful antimonial both upwards and downwards, he was relieved from all his worst symptoms, and restored to ease, rest, and sleep; the leucophlegmatic swelling, extending from the tumor to the foot, was discussed from time to time by the occasional application of astringent fomentations.

Then the opening up and sloughing of the tumor began, or the necrosis, as the ancients called it, i. e. the gangrene, death, and separation of the injured parts. "In three days," says Severinus, "after those changes which I have just described, nature began to throw off that insensible part which remained in the centre of the tumor; upon observing which, I cauterized that central part with red hot irons, and repeated this cauterizing, morning and evening, for five days." The great slough being removed, there appeared under it a fleshy-like membrane, perforated at various points, and beneath it the tumor or sac itself full of black and grumous blood: Now Severinus cauterized with very broad and flat irons, applied one above another; he repeated the same next day; in the evening he drew out a full pound of coagulated blood, and in the night some ill-smelling blood issued from the opening.

Next day he cauterized all over the surface, plunging the iron, hissing among the stuff, as into water; he now used four large and flat cauterizing irons; and in the evening, upon lifting up the poultice, he took out, with a large spoon, fully two pounds of blood: Next day he plunged in the irons again, and raked out the blood, which now had a horribly offensive smell, growing daily worse; and in cauterizing in the evening, he extracted again, with his spoon, two pounds and a half of this putrid and grumous blood.

He now began to put into this great cavity astringent powders of alum, sal-ammoniac, and some iron preparations, and laid over all cloths, with unguentum Egyptiacum, having first thrust in tents spread with it. In this manner was the aneurismal cavity dressed every six hours, extracting at each time great quantities of corrupted and very fœtid blood; and some days after this kind of dressing was begun, he tore out, with his forceps, a piece of spongy-looking flesh (probably a firmer coagulum of blood) of about a pound weight, from which time he continued the same medicines, but used them more sparingly.

When in a little time this flux of putrid blood had ceased, and nothing remained except putrid flesh, that is, the canals of the veins and arteries, and the fibres of the putrid muscles and tendons causing an intolerable fœtor, having extracted a part of this putrid stuff, and finding less of it next day, he began to use a mundificative, the wound having been first washed with wine, spirits, salt, and honey, (an odd composition, but powerful enough if used strong), a putrid nerve of three inches long (half a palm) having been extracted, the wound was tolerably clear; thus the mundificative was applied, and next day the whole wound seemed purged and clear, and the bone lay bare about an inch in breadth, and three inches (half a palm) in length.

Severinus then took a reed, and blew in catagmatic powders upon the bone, and over the whole surface of the cavity; the hollow or basin of the aneurism was of such size, as to require no less than half a pound of lint to each dressing to stuff it with. He dressed the bone particularly with the catagmatic powder, and moistened with spirits of wine all the naked part of the bone; he laid over all an ointment made with gum elemi, and he washed the general surface frequently with Aqua Gurgitelli; and he very seriously attributes the blackening of the bone, its total exfoliation, the rising up of the granulations, the generation of flesh, and whatever good pus was poured out, all to his Aqua Gurgitelli and catagmatic powders, as if the man had not been alive, and nature working in his limb to more purpose than the physician. The quantity of serum discharged was so great as to require dressing twice a day; at one time the running was so great that they were obliged, besides the lint, to use sponges to suck up the moisture, and the limb downwards from the knee to the ancle was greatly pained and convulsed, for which it was rubbed with turpentine, oil of wax, and cock's grease: But the cure advanced, flesh was granulated, the bone was covered with granulations, though sometimes the parts looked so ill, and the matter was so profuse, that they needed to dress thrice a day. How Severinus continued to dress the bone, and assist the granulation, it were tedious and useless to relate; it is sufficient to observe, that the cure was going on from January, the time of the gangrene, to the end of August; that the flesh of the groin filled up perfectly; that the patient walked well and firmly, sometimes using a short stick, but sometimes also walking well without one."

This is a singular case, and a very tedious cure; but it is not because the history of the disease is related with many touching circumstances that we read it with interest; this phenomenon of the obliteration of the great artery of a limb is one of the most extraordinary in the economy of the human body, and is always attended with circumstances which must interest us in the fate of the patient so near death! so miraculously restored.

The rivals of Severinus accused him of curing so desperate a case only by witchcraft and enchantment; but if there was any thing of this kind in the cure, says Severinus, it was only the miraculous power of fire. Severinus himself, ignorant of pathology, ascribed every thing fortunate in this case to the power of fire and his catagmatics. He believed, like Morgagni, that the artery survived amidst this wide destruction of parts, and, like Morgagni, was astonished at his own success.

This case adds one more proof to those which I have taught you. When the pulse ceases the artery is oppressed; while the artery is oppressed by its own aneurism, the inosculations are enlarging; every thing is prepared by nature for the ultimate change! The main artery is obliterated, the inosculations nourish the limb; the aneurism may burst, but the patient cannot bleed to death. When the parts gangrene down to the bone, and the bone itself is exposed, black and carious for three inches in length! when a nerve, as Severinus calls it, some inches long, is hooked away with the other sloughs! when the great crater of such an aneurism is dressed to the bottom, to the very bone, for seven months! we need not inquire how the artery has reunited so as to perform its functions. Such artery is destroyed, and the inosculating branches of the profunda perform its office! Nature has saved the patient from the bursting of the aneurism, and the limb from the destruction of its artery, the chief difficulty of the physician is to save the patient from the wasting which accompanies such an extensive sore, whose surfaces, external as well as internal, are all gangrenous, and slough like a great gunshot wound*.

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* "Some years since, I was desired to give a visit to a man lying in my way to Whitehall. He had a large white tumor possessing the fore part of his right thigh, of a few months' growth; it was soft from the first appearance, and observed by the patient to be bigger and lesser one time than another. I considered the swelling, and concluded it an aneurisma. That there was no pulsation to be felt in it, was because it lay deep among the muscles, in which case the pulse is frequently intercepted. There lay a gummy emplaster upon it, and an attempt had been made to open it by caustic; but it not penetrating deep enough, the escar separated without reaching near the cavity. I declared to the patient my thoughts, viz. That the swelling proceeded from blood poured forth of its vessels, either by erosion from within, or by some outward cause, as by riding, &c. and advised him not to permit the tumor to be opened, desiring that, if his chirurgeon should persist in the suppurating or opening of it, he would send to me to meet him."

"Some few days after, the patient sent me notice that his chirurgeon had been with him, and resolved to open it; whereupon I took the next opportunity to speak with the chirurgeon, and went along with him to his patient; where I endeavoured to persuade him that the swelling arose from blood, and withal proposed a palliative cure by a laced trowze and some good restrictive. But the chirurgeon declared himself positively for the opening of it. I seeing his resolution, replied, Since you are so opinionated, you may (if you think good) make a trial of the tumor, by thrusting a small lancet directly into the middle of it; and if, upon pulling out of the lancet, it appear mattery, you may lay it more open; if it appear bloody, you may more easily cure it than one made by a caustic. He readily assented to the trial, and the patient rejoicing in the proposal, he attempted it with a lancet; but not thrusting it deep enough to reach the cavity, I took the lancet, and, passing it into the same opening he had made, thrust it directly down into the cavity, and pulled it out bloody, but not one drop followed it. The chirurgeon not being therewith satisfied, I wished him to pass a small probe down into the opening: He did so; and I also made a search with the same probe, and felt the cavity large and full of liquids, which was certainly blood, the probe coming out bloody. I persuaded the patient to keep his bed till that puncture should be agglutinated, and advised the chirurgeon to be careful in the cure of it. We dressed it with a pledgit of Leniment. Arcæi, with emplaster and

But hitherto I have spoken only of natural cures, in which there is a slow distension of the artery, and a gradual dilatation of the inosculating branches, where the blood is worked slowly on from branch to

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a bandage : to the use of which medicine I left them, not doubting of their care in healing up so small a puncture. About ten days after, walking near the door in a dark evening, weary, and desirous to rest myself, the thoughts of this poor man inclined me to go into the house. I inquired of the landlady if he was within? she replied, He is dying: That upon the rising out of his bed, the blood had burst forth excessively: That the chirurgeon had for some days endeavoured to stop it, but had since left the patient, and a neighbouring woman had applied a poultice to it; and that the chamber stunk so extremely, as it would poison me to go into it. I went up, and found the room scattered with stinking bloody cloths, and the poor man languishing in his bed, which was not cleanlier. I sent presently away for the chirurgeon, and in the mean while made rollers and compresses, and sent for some yeast and wheat flour. The chirurgeon being come, we spread a mixture of them upon cloths, and armed several tents with the same. Having thus prepared our dressings as the time would permit, we took off the bloody ones, and held the orifice clean, while we cleansed the thigh from the poultice and blood, then stopped the orifice with a tent proportionably, and applied our agglutinatives over, with compress and bandage wrung out of oxycrate. We rolled the member moderately strait, then laid him clean, and caused a mess of caudle to be given him, and encouraged him with hopes of recovery. The chirurgeon pleaded for himself that he thought the patient had been dead.

"Three or four days after we dressed him again, and found him much recruited in his spirits, he not having bled one drop; and indeed the emplasters adhered as close to the skin as we could desire. After we had taken out the tent, abundance of grumous blood issued forth: we cleansed it away, and shaked into the abscess about a drachm of Merc. Præcipitat.; and though we had then choice of medicaments, yet we applied the same as before, and continued that method of dressings, till the blood was converted to matter. Then we slit open the orifice, and dressed it as a sinous ulcer. After some days, observing that the matter could not discharge while he kept his bed, till the abscess was full to run over, we caused him to rise out of it; but that little while he was up he swooned; wherefore we put him to bed again, and allowed him stronger nourishment, and by a seton needle made way for the discharge of matter to more advantage. The abscess being well disposed to cure, I left him again to his chirurgeon, who cured him."

"This experiment of opening aneurisms by puncture is not to be imitated, unless it be in such cases as this, where both patient and chirurgeon are so incredulous." WISEMAN, p. 23.

branch, till many are enlarged, and much blood is conveyed by the collateral arteries before the main artery is choked up. But is it not still possible that, were the limb suddenly deprived of its main artery, gangrene might ensue? It shall next be my business to prove, that the artery being tied, and the blood suddenly intercepted, the limb will not fall into gangrene.

"Thomas Morris, a seaman, twenty-four years of age *, one of the crew of the Fishguard, was wounded across the top of the thigh with a musket shot, in an engagement with the French frigate l'Immortalité. The wound was three inches in length; it passed across the thigh, from within outwards, a little way below the edge of the crural ligament. He ran down to the cockpit, where his cries were so outrageous as to surprise the surgeon, who saw only a superficial wound, without even the usual degree of hæmorrhagy; but it will presently appear that this excessive pain must have proceeded from the laceration of the anterior crural nerve, which lies on the fore part of the femoral artery, enclosed along with it in the same sheath.

"He was laid in Plymouth Hospital on the fourth day of his wound, (the twenty-third day of October, 1798). The wound looked black and sphacelated; the sloughing was already begun: On the fifth day

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* This case is transmitted to me by Mr. Stephen Hammick, junior, of Plymouth Hospital, as a confirmation of what I have said concerning these inosculations of the profunda in my former Book on wounds; and his letter is full of such flattering expressions as I cannot repeat, but I am not insensible of them, nor of the care with which Mr. Hammick has drawn out the case for my private use; but such a debt is best transferred from myself to the public; Mr. Hammick will be always known for his zeal in his profession.

the sloughs began to be thrown off; and on the evening of that day, he, for the first time, lost blood to the amount of two pounds, but this hæmorrhagy ceased before the surgeon could be called. That night he passed in a very restless and agitated state; and next day, the sixth from the time of the wound, at eleven o'clock in the morning, while one of the gentlemen was removing the dressings, the femoral artery itself burst, and threw its blood with prodigious force; but he immediately thrust a compress into the wound, maintained it with a firm pressure, and so suppressed the bleeding."

"Mr. Hammick was sent for, who, being in the same building, very soon arrived to the patient's assistance; and the compress being a little raised, he laid hold, with his forefinger and thumb, of the upper part of the femoral artery; with the left hand he removed the clotted blood, dilated the outer edge of the wound, that he might strike the needle more freely; and then passed the needle under the artery; and with a firm ligature, tied in at once the artery, the vein, and the anterior crural nerve. They could not be separated from each other from the artery being ruptured so very high. He would also have applied a ligature below, but the disease extended downwards along the lower part of the artery: that intention was therefore forsaken, and a compress and roller being applied, the patient was laid to rest with an attendant watching by him day and night."

"A total deadness, as the man expressed it, with inability to move the limb, immediately ensued; and half an hour after, the heat of the limb being measured by Fahrenheit's thermometer, was found ten degrees lower than that of the sound limb. He slept, or rather dozed, during the whole afternoon, complaining but little; towards evening, about six o'clock, he said he could feel the diseased limb as well as ever, and he moved it into another posture without help; its natural heat returned; the temperature of both limbs were now equal, the pulse quick, and the symptoms moderate. This first night he passed tolerably well; he slept the greater part of it; but he was once, during the night, alarmed with a fearful dream, and awoke in great terror. The wounded leg was now rather warmer, the pulse very quick; he complained much of thirst. He was feverish during the whole of the following day; it was about nine in the evening that the fatal bleeding came on; at nine in the evening the hæmorrhagy first burst out, and he lost about two pounds of blood; it was soon suppressed by applying a compress, and it was observed that the ligature of the femoral artery was perfectly secure, the blood had come only from the lower part of the wound: the man was greatly exhausted by this hæmorrhagy, and in such cases the slightest return of bleeding is fatal; next morning a slight hæmorrhage appeared, and he expired about eight o'clock, viz. forty-five hours after the bursting of the femoral artery*."

"Mr. Hammick was not permitted to inject the limb, but he dissected it with particular care. He found his ligature perfectly secure; it was placed close to the ligament of the thigh. The artery below this was in a sloughy condition, quite sphacelated;

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* This is a counterpart of the case which I have given of a wound of the crural artery."

its walls full of holes; and this state of the artery extended from the groin, where the ligature was applied, a great way down the femoral artery; it began about the eighth of an inch below the ligature, and continued three inches beyond the point where the profunda goes off. The upper part of the profunda, and the orifices of the two circumflex arteries, were diseased; much coagulated blood lay behind the arteries, filling the interstices of the muscles. The anterior crural nerve was enclosed in the ligature, and some of its fibres were transfixed by the point of the needle, and divided."

All the steps of that process, which I have represented to you, are well marked in this case. This is an example of the secondary hæmorrhagy peculiar to gun-shot wounds. The ball had not cut nor wounded the femoral artery, but grazed it. The ball had passed close upon the artery; it had even torn the sheath in which the artery is enclosed; the extreme and frantic pain which this man suffered can be accounted for only by the wounding of the anterior crural nerve, and that nerve lies along by the artery, enclosed in the same sheath with it. When the sloughing, or, in other terms, the gangrene of the wound began, the vein first gave way, and there was a slight bleeding, easily suppressed by a compress. When the deeper sloughs fell off, the artery itself next gave way, with an impetuous gush of blood. When the artery was fairly surrounded with the ligature, and its blood suddenly intercepted, the deadness and coldness (so perceptible in less than half an hour) showed how few of the arteries of the limb were then in an active state, how sudden the effect of the ligature was. When the heat, sensibility, and motion of the limb returned, and the temperature of this limb rose above that of the sound one, it was demonstrated that the whole vessels of the limb were then excited to strong action to supply the loss of the femoral artery. The circulation was re-established all at once, just as in our injection the fluid goes round, by one stroke of the syringe, from the arteries of the pelvis to those of the thigh. And, finally, The return of the blood by the lower part of the artery, while the upper part was secure by the ligature, demonstrates that kind of circulation which is already sufficiently explained. It was this secondary hæmorrhagy from the lower part of the artery that was fatal; the blood had come down through the sciadic and thyroid arteries, had poured into the profunda, and had welled out through the criblous or sieve-like part of the sloughing artery. To have saved this man's life, then, the blood must have been opposed at this point, and forced to pass through still another circle of inosculating arteries. In place of being allowed to enter the profunda, or femoral artery, it should have been forced on through a second set of inosculations till it reached the main artery by the small articular branches of the ham. Mr. Hammick has the politeness to ask, What should have been done? To have cut downwards to the sound part of the artery would have served no good end. Ligature in such a case was impossible. Ligature, in any case of hæmorrhagy, from sloughing or gangrenous arteries, is not to be trusted; for sloughing opens various passages for the blood, which no single ligature can command.

Had an injection been thrown into this limb after death, it would only have spoiled the dissection, for it would have exuded through many arterial mouths; not only from the criblous part of the sloughing artery, from the profunda, and from the circumflex arteries of the joint, but from every small inosculating twig that opened upon the inner surface of this gangrenous sac. Perhaps this sac should have been filled with dry and firm sponges, and the limb rolled from the toes upwards with a firm bandage. Pressure and the sponge are, I apprehend, sufficient to oppose every secondary hæmorrhagy proceeding from inosculating arteries and refluent blood. Pressure would have been sufficient, perhaps, to turn the blood still farther round into more distant channels; a sponge and pressure are alone fit to oppose hæmorrhagy from a broad and gangrenous surface *.

But, in justice to this interesting subject, I must lay before you one case more, which I am induced to do for two reasons; in the first place, the case is perfect, the patient having lived; and, in the next place, I have but to present the case to you in a fair translation: the chief accidents of it are already explained; and if you reason for yourselves, as I have argued on the other cases, you will find it clearly proved, that in the following operation (which was performed by the celebrated Guattani), not only the profunda was compressed along with the femoral artery, but the external iliac was so compressed also at the passage from under Poupart's ligament, that every artery on the fore part of the thigh was stopped.

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* When the main artery of a limb is tied, a compress and roller confines the activity of the collateral arteries, so as to endanger the life of the limb; this advice of my brother is therefore to be very cautiously pursued.

"A goldsmith of the name of Morellus, fifty-five years of age, consulted Guattani about opening a tumor in the groin, which all the other surgeons declared had come to a perfect suppuration. Morellus had, during the whole winter, complained of a settled pain in the right groin, sometimes milder, sometimes very violent, but never absent; accompanied, during the winter only, with a degree of lameness, but now in the spring it had begun to swell. When this unlucky Morellus, going along with others on the fourth of June to St. Peter's, to see the pompous ceremony of the consecration of the host, was seized suddenly with such dreadful pain, that he was obliged to go home, and partly from fear, partly from the violence of the pain, went to bed and lay for three months under the care of his physicians, their prescriptions all ineffectual, his disease increasing daily. The unfortunate Morellus, now almost hectic, was entirely confined to bed; there was great swelling of the groin, contraction of the thigh, (so that he could not stretch it out), and a distinct fluctuation in the groin, which extended from the symphisis pubis to the spine of the ilium, but still without tension or pain; on the contrary, the fluid fluctuated freely, and seemed to be immediately under the skin."

"Guattani could not allow himself to believe this to be a proper suppuration, because the fluctuation brought no relief; and, though there was no pulsation, he yet suspected aneurism, and explaining himself on this head to the consulting physician and surgeon, Amicio and Maximinus, both professors in Rome, they agreed to spend a few days longer in trying common remedies, partly that they might make a trial of such remedies as might be thought advisable, but chiefly to allow time to Guattani to make up his mind concerning the nature of this disease."

"After fifteen days, they found no change, except a new suppuration within four fingers' breadth of the great trochanter, and therefore resolved to do the operation, and to cut into the groin at the place the most favourable for stopping the flux of blood, in case of Guattani's fears about aneurism being well founded. But lest the assistants or friends, and more especially the patient himself, should be alarmed with the sight of blood, Guattani talked over this subject with the patient, assured him that he had provided every thing for stopping the blood, and explained to him at the same time how easy it would be to enlarge his small incision, in case of there being pus only in the tumor; he mentioned also, that in case of pure blood flowing, he would presently give it a free exit, so as at least to empty the bag, and would let the fresh blood run out, even after the emptying of the bag, if his strength would bear it; after which he pledged himself to secure the artery by compression, if he could only get his compress fairly put down upon the artery itself." "After all this," says Guattani, "I trust there will come on a good suppuration, and that you will be restored to perfect health; at all events, this is expressly what must be done, and all that can be done to attain that desirable end."

"Morrellus heard me," says Guattani, "with a composed mind, and we proceeded to our operation boldly; being provided with basons for receiving the matter, and compresses and bandages for commanding the blood. Then the surgeon Maximinus introduced his curved bistoury delicately into the highest point of the tumor, near the crista ilii where the skin was particularly thin, when instantly pure blood gushed out violently to the great alarm of all present. But, encouraging the patient, I took one of the basons," says Guattani, " in my own hand, and extracted such quantities of blood by this small opening, that I filled one bason, took up a second, and still continued my work, till the pure arterial blood began to flow, and the patient to faint." The blood was stopped by Maximinus clapping his thumb upon the orifice; and Guattani, by graduated compresses, piled one above another, with firm bandages, so suppressed the bleeding, that the patient did not faint, but, on the contrary, was presently relieved from all his fever and pain; and being supported with cordials from time to time, he went on without either bleeding or any other bad symptom, and without needing even to have the bandage undone till the thirteenth day, when, the dressings being removed, nothing flowed from the wound but a little pus; which showed that the artery was fairly closed, and encouraged them to go on with the cure. Although the suppuration was not excessive, they were forced to make a counter-opening; they accomplished the cure in little more than two months.

Now the discharge of coagulated blood only followed at first by a discharge of fresh arterial blood; the patient feeling no lowness nor debility during the emptying of the great bag, and his fainting whenever the pure blood began to run, prove this to have been an aneurism; and Guattani's intention in allowing some of the arterial blood to escape, was, that he might have a greater command of the artery, and be enabled to compress it.

It signifies nothing to the point, whether this was or was not an aneurism; nor, if truly an aneurism, does it signify whether it were an aneurism of a branch only, or of the main artery of the thigh; nor is it of much importance whether the aneurism was above or below the point at which the profunda goes off. The question is, whether the main artery was stopped above the profunda by the violent compression which they needed to make? And this is solved by Guattani's reflections upon the case, which are as follows:

" This case settles," says Guattani, " two great questions which disturbed me very much; for, in the first place, the pressure was such as to prevent the least drop of blood from passing down the artery, whence I was satisfied that the limb was nourished by the internal iliac artery alone; and since this aneurism was cured by compression merely, I am satisfied that compression will cure any aneurism, whether from wound or from disease."

The strong conclusions of this case, also, the celebrated Murray tries to escape, by saying, " Vero simile videtur, arteriam femoralem supra inguen jam divisam fuisse, nam alioquin, toto trunco compresso, vix ausa tam fortunate cessissent." If this femoral artery did actually divide into two equal trunks, which way could they pass along to the thigh but over the pelvis? or how escape that compression which obliterates so effectually both the femoral artery and the profunda? Yet why should we allow ourselves to argue thus about a mere hypothesis? This is but the old analogy of the brachial artery forking high in the arm! a lusus naturæ is imagined to fulfil that purpose for which nature has so very amply provided; those authors would rather have a limb saved by miracle than by the provisions naturally belonging to its own organization! But you know by what provision of nature such a limb is saved, and how to overlook the authority even of Murray when opposed to facts.

[My brother has here given a powerful piece of reasoning: the anatomy of the arterial system is put to its proper use; the facts are discovered with a surprising industry and acumen; and the history of surgery most happily applied to its improvement. The reader must recollect that all he now knows of the operations for aneurism, with the exception of Mr. Hunter's great improvement of tying the artery on the fore part of the thigh, were not known or contemplated at the time this was written; that all with which he is now familiar in our books of cases, and in the works of Scarpa, were not then written; to form a just opinion of the importance of these doctrines, he should look into the books which were in the hands of surgeons of that period.

There is another way of judging of their importance:—The contemplation of the rapid course of events since that time; the operations on the iliac, the carotid, the subclavian arteries; and all the bold operations performed on the arteries, by which the character of English surgery has been raised so high.

I stand in a most delicate situation, as the commentator on my brother's work, and as the friend of the men who have accomplished these great operations;

but I must express my opinion, that the reports of these great operations are given with a remarkable deficiency in the statement of principles, and a more remarkable absence of the name of John Bell, who had so clearly pointed to these conclusions,—to these very operations, as the natural result of his arguments.]

CONCLUSION.

There is no general fact in all the circle of pathology of which we are more absolutely assured, than of this universal inosculation of the vessels of a limb, and of the general obliteration of its arteries, without any danger of gangrene. The proofs which I have laid before you are like a great experiment, varied in every possible form, and with circumstances so peculiarly striking, as to impress the fact on our imagination, as well as to satisfy our reason. In one case, a natural aneurism is enlarged to the utmost possible extension, the parts ready to burst, the artery obstructed even by the pressure which its own disease had produced ; the limb lying swelled and deformed, with hardly any remains of vital heat, verging towards gangrene. Then the collaterals enlarge, the limb warms, the circulation returns ; the limb, at last, grows turgid with blood, its heat rises beyond the natural standard, and the patient awakens as from a sleep of death. When the limb thus recovers, the swelling subsides, the strength of the limb is gradually restored, but in the place where the trunk of its blood-vessels should be found, there is only a firm cord of ligamentous substance, knotty and hard, occupying the bed of the obliterated artery.

In a second case, we see the same process under another form. The aneurism bursts within, the blood is driven far and wide among the cellular substance, the artery is torn up from its bed, and insulated and compressed, the muscles are displaced, the extravasation occupies every interstice, the parts and their functions are disordered to the utmost degree, but the distension stops short of gangrene! the aneurism bursts at last, the circulation on the fore part of the limb ceases, that along the back part of the limb is established, the patient lives some weeks, and then expires, exhausted by fever, pain, and every kind of distress. Upon opening this limb, the artery is found to have been dilated into an aneurism, the canal of the artery is found choked, at its upper part, with a firm clot of blood, the aneurism is found to have burst in the middle space of the artery, and at its lower part the artery is flattened, its sides have adhered, and its canal is obliterated where it approaches the ham. Such a patient surviving this destruction of the vessels during four weeks, is as sufficient a proof of our doctrine as if he had lived for years.

But still, as if for our entire satisfaction, another variety of the case appears: the aneurism bursts internally; the circulation is for some hours almost interrupted; the heat of the limb is at length restored; the artery is obliterated, and discharges no more blood, but it has already injected the cellular substance with blood beyond what living parts can bear; they gangrene; the skin bursts; the thigh opens, as if to show what had passed within; the parts slough like the surface of a gun-shot wound; the cellular substance is purged away by suppuration till the muscles are cleansed; you can count the muscles as they lie in the bottom of the great sac; the triangular hollow which lodged the great vessels is exposed. Though the great vessels have been long destroyed, yet the patient continues to live; or, if he dies after much suffering, it is only because he is exhausted by the fever and profuse discharge.

Yet this is but as a theory; these facts do no doubt establish a sort of abstract point of doctrine, "that though the great arteries of a limb be destroyed, the limb may survive;" yet there is here no authority for the practical surgeon, who is responsible for every new and dangerous operation; he must have proofs more relevant than this, and such proof we have in the two operations which I have last described. In the case by Mr. Hammick, the femoral artery was torn or burst from sphacelation, and the current of its blood interrupted! it was tied close to the groin! after an interval of suspended circulation, the limb recovered its heat, and there was too fatal a proof of a lively circulation, for in no long time the circulation became too powerful for the weakened arteries to resist; that blood which was now passing freely, and nourishing the limb, burst out from below through the sphacelating and sloughing artery; it was in consequence of hæmorrhagy by this retrograde channel that the patient died.

But, last of all, in the case of Morrellus; the operation for aneurism was boldly and successfully performed by the two great Roman surgeons Maximinus and Guattani, who, amidst a confusion of blood and matter, aneurism and abscess, sought out the artery, found it, obliterated it by compression, and actually saved the patient from death that seemed inevitable.

As I proceed in this important subject, you will find me describing a variety of aneurisms; and since I have taught you to reason upon these facts, you will without my assistance perceive, that in every aneurism cured by bandage the artery is obliterated by compression, and also that every aneurism spontaneously cured, is cured merely by the obliteration of the artery. But I am now engaged in explaining the efficacy of inosculating arteries; and one department of the circulating system remains to be slightly noticed, I mean the economy of the arteries of the arm, where also the powers of the circulation will be found equal to every interruption.

THIRD, OF THE INOSCULATIONS WHICH, IN CASES OF ANEURISM OR WOUND, SUPPLY THE PLACE OF THE BRACHIAL ARTERY.

Though the arm is smaller than the lower extremity, a circumstance worthy of attention, according to the doctrines of the older physicians, this did not at all abate their apprehensions, they believed that stopping the axillary artery must be followed by gangrene of the arm! But according to the doctrine which I have laid down, the size of a limb makes no difference in this argument, the arteries of each limb are proportioned to its bulk, the inosculation of arteries is essential to the sound constitution of each part, and the inosculations of arteries are proportioned to their size; the arm, like the lower extremity, is endowed with every provision for supporting its circulation under the accidents of wounds and aneurisms; its arteries are proportioned in size to the bulk of the limb; and the order of the inosculating arteries in the upper and in the lower extremities is nearly the same.

First, The arteries which surround the fleshy joint of the shoulder may be very aptly compared with those which surround the hip. One very long and slender artery comes out of the thorax; it is among the first branches of the subclavian artery, often it is an independent branch, not unfrequently it is the chief branch of the lower thyroid artery: it is long and tortuous, and passes directly across the root of the neck; it enters into the notch in the upper border of the scapula, and supplies the muscles which cover the shoulder blade; it is called the Transversalis Humeri, but should rather be named the Supra-Scapular Artery*. This is a branch on which we may rely, for it makes many inosculations with the next branch, the sub-scapular artery.

Secondly, The sub-scapular artery is exceedingly large; it is equal in diameter to the humeral artery itself; it bears the same proportion to the axillary artery that the Profunda Femoris does to the iliac artery at the groin; it comes off from the axillary artery nearly opposite to the shoulder joint; it turns immediately round the edge of the scapula, and makes very free inosculations with the extreme branches of the supra-scapular artery, and with those long and slender arteries called Cervical, which twine round the root of the neck and top of the shoulder.

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* This artery is regular, in so far as relates to the scapula, but in its origin it is quite irregular. This great artery going over the scapula, named Supra-Scapular artery, or Arteria Dorsalis Scapulæ, most commonly comes from within the chest, being the first great branch of the Thyroid Artery; sometimes it proceeds from the Cervicalis, or artery of the neck; sometimes it comes off upon the outside of the chest; it makes large inosculations, and is the branch particularly to be depended upon; but all the cervical arteries assist with their lesser inosculations, and all of them, or any one of them, may be so enlarged as to perform this office of filling the trunk of the artery below the axilla, and so nourishing the artery.

The third artery is a great one, though often it is but a branch of this sub-scapular artery; it comes off at the joint, and no sooner does it leave the axillary artery, than it turns quickly round the joint, to which it is so entirely appropriated, that it is called Articularis, or Circumflexa Humeri, from its course round the joint; while the supra-scapular and sub-scapular arteries nourish all those muscles which lie upon the scapula, this artery supplies the deltoid muscle, the shoulder joint, and the arm bone. Such is the size of these arteries, the frequency of their inosculations, and the fleshiness of the joint, that injections pass easily from the subclavian artery into the humeral artery, although the intermediate part of the trunk, viz. the axillary artery, be tied. Often, when we have tied both axillary arteries with the design of injecting only the head, we find that even our coarsest injection has passed freely into the artery of the arm; and thus that point of the circulation which surgeons have been most doubtful of, is perfectly ensured*.

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* Whether the great artery be wounded just where it comes from under the clavicle, i. e. betwixt that great branch which goes over the scapula and that which goes round the scapula from below, or whether it be wounded betwixt the lower scapular artery and the

Next, when the artery passes the border of the axilla, and takes the name of Brachial Artery, it gives off one or two branches, which resemble the profunda femoris, as far at least as an analogy can hold betwixt so bulky and so small a limb. These arteries are called Muscular Arteries of the arm, or Muscular Spiral Arteries, from the spiral form in which the uppermost of the two twines round the arm; they are named Profundæ Humeri, superior and inferior, from the analogy of the femoral artery; they are named sometimes Collateral Arteries, because they run parallel with the trunk of the humeral artery. These two arteries terminate in twigs, which encircle the naked and bony joint of the elbow. One curls round the inner condyle, and the other (the muscular spiral), which, by passing round the arm has got to the outside of the arm, twines round the outer condyle. These arteries are long, slender, of the size of crow quills; the twigs they distribute round the elbow joint are small and curling. Along

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profunda, still the limb is safe; we are assured of it by cases; we foresee the success of all such operations by the success of our injections: I have often found that when, even in the oldest subjects, I had pushed injection (of the coarsest kind) from the arch of the aorta, trying to save the arteries of the arm for a second injection, by tying both arteries in the axilla very securely, I have, notwithstanding, had an injection of the arteries of the arm; sometimes in both arms, more frequently only in one; but even one experiment of the kind, and one arm injected, would be a sufficient proof.

And you will be inclined to consider this proof as a very strong one, when I inform you that our coarsest injection goes thus freely round the inosculations of the shoulder (where we are so much afraid of performing an operation), while even tepid water will not pass, or will scarcely pass, round the inosculations of the elbow, where, in our operations for the common aneurism, we are so sure of success.

with these there goes a branch round the inner condyle, which comes off from the humeral artery about three inches above the elbow, near the middle of the arm; it descends towards the inner condyle, it is slender and tortuous like the branches of the profunda, and it is distinguished by the name of Ramus Anastomoticus Major. These three arteries then twine round the several projecting bones which form the elbow joint. The humeral artery having reached the bend of the arm, divides into the three well known arteries, the Radial, Ulnar, and Interosseous arteries; they resemble the three arteries of the leg, and each of these sends back a little artery, which, turning quickly round the elbow joint in a retrograde course, mixes its branches with those of the ramus anastomoticus and of the profunda. These are named the Recurrent Arteries, and they are the arteries which support the limb after the common operation for aneurism in the arm. We see and feel the actual enlargement of the artery which supports the limb, and it may be seen to be very much enlarged in the specimens which have been preserved of aneurism at the bend of the arm; and it adds strength to the general conclusion, that while the inosculations of the large and fleshy joint of the shoulder transmit our coarsest injections, those inosculations of the elbow joint hardly transmit tepid water in their natural and undilated state, and yet never fail to support the circulation of the blood after the operation for aneurism.

This is the economy of the arteries of the arm, and these the inosculations upon which we have now learnt to depend with perfect confidence; but this is a degree of boldness which we have acquired by very slow degrees. It is principle alone, and the study of the arteries, that can give us confidence; and the study of the arteries, essential as it is to the practice of our profession, has been entirely neglected by surgeons. The inosculating arteries have been observed only by professed anatomists, and that very slightly. So little have surgeons acted upon principle, that when any important question of this kind has presented, the conclusion has always been, "Let us try whether the inosculations will so enlarge as to save the limb." Wounds of the femoral artery were always considered as fatal to the circulation of the limb, which was accordingly cut off. The operation for aneurism of the ham was, from mismanagement and bad surgery, almost always fatal. In wounds of the axillary artery there was no question made, the limb was cut off without delay. It was many ages before surgeons ventured to tie the artery, in aneurism, at the bend of the arm. For a long time after they did perform the operation, it was done with great fear and anxiety, and they kept the amputation instruments ready at hand, that they might cut off the arm the moment it began to gangrene! although this much dreaded gangrene, in the course of nearly a century (during which we have continued to perform this adventurous operation), has never once appeared. When this operation did succeed, the older surgeons wondered at their own good fortune, and ascribed it to one of two causes, either that the branch only of the humeral artery, viz. the ulnar artery was wounded by the lancet, and not the trunk!

or that the humeral artery divided near the shoulder, far above the place of the wound! That the trunk itself was wounded, tied, obliterated, and yet the arm saved, they could never believe; even repeated success could hardly inspire them with confidence. Where is the case related in which gangrene followed from the interruption of the blood? No where. And yet, to this day, the arm, after such an operation, is laid in particular postures, and wrapped in flannel and furs, and fomented with spirituous embrocations, all to restore the circulation! as if the surgeon could perform, or even promote that process which nature alone can achieve, and has, indeed, very carefully provided for. The surgeon's self-approbation, when the heat of the limb revives, is like the pride of the fly on the chariot wheel. He puts his oar in the water, but he is carried by the tide and the stream*.

Heister believed, that wherever we cured the aneurism of the arm by tying the artery, the arm was saved by a high forking of the artery, and it was only latterly that he began to suspect that the smaller branches might sometimes be so far enlarged as to carry the blood freely; because he had occasionally observed, that after the operation for aneurism, there was no pulse in the wrist during three days, after which it began to be perceived, and soon returned to its natural strength *.

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* We find the celebrated Ruisch speaking of this operation in the following terms:—" This is an operation which surgeons chose rather to describe than to perform. I have good reason to say so, since for more than twenty years, in all this great city, to which so many under all kinds of ailments crowd for assistance, no surgeon, as far as I have heard, has ventured to tie so great an artery."

It is commonly said, that Ruisch was actually the first who had performed this operation in Holland; whereas the passage stands thus:—" Operationem sane ab authoribus majus commendatam et laudatum quam institutam; quod dicere non gravor, quia viginti abhinc annis, et quod excurrit in hac vasta civitate, ad quam sine numero confluunt afflicti, hanc operationem in arteria adeo ingenti nullus (quantum noverim) chirurgorum instituit."—Ruisch, Vol. I. Observ. 2.

"If the axillary artery be wounded," says Mr. Gooch, "it is necessary to take the limb off at the joint; yet as there are instances of the brachial artery dividing into two soon after it leaves the axilla, which lusus naturæ I have observed at different distances in the arm (for Mr. Gooch had a natural turn for observing these lusus naturæ), it will be rational practice, when we feel a pulsation at the wrist, to treat such case as an aneurism, by tying the artery," &c.—Page 72.

In short, there were two accidents with which the older surgeons encouraged one another to this operation, viz. first, that the artery forked very high in the axilla; or, secondly, that in common an artery touched with the lancet in bleeding, was pricked not in its trunk, but only in one of the two branches into which it divides at the elbow. Thus Chesselden says, "I had always thought this wound was in the inferior cubital (i. e. in the ulnar) artery, and thus

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* "Posse vero ramulos minores se ita sensim dilatare, ut § XXXVIII. diximus, Clar. Du. Præses inde suspicatur, quia cum aliquando truncum arteriæ brachialis internum, graviter vulneratum, prædicta ratione supra vulnus ope fili circumdicti ligasset, intra triduum nullum in arteria juxta carpum posita, quæ à medicis explorari solet, pulsum sentire aut percipere potuit: posthæc vero hanc arteriam, primo levissime micare, sensim vero sensimque penitus pulsare sensit."

the sudden reflux of the blood was accounted for, by the communication of the two cubital arteries in the palm of the hand, and thus satisfied, I inquired no further; though Mr. Sharp, even so long ago as when he was my apprentice, told me that the wound was in the trunk, in the humeral artery itself, as indeed it is."—Page 457. And yet the celebrated Dr. William Hunter, notwithstanding this affirmation of Chesselden, lays it down in the most formal positive manner, in the shape of a practical rule or inference, we know not what to call it, marked xv. "That though the brachial artery in most people divides into its two branches a little below the part where we commonly bleed; yet perhaps it will be found, that the aneurism happens oftener to one of the branches than to the trunk of that artery, because these often lie nearer the skin, and are thereby more exposed to injury."—Page 353.

This has nothing in it of the usual correctness of Dr. Hunter, for in point of fact it is wrong; the branches do not lie nearer to the skin, they are buried deep, not under the fascia only, but under the bellies of the pronators and flexors of the arm, and any one may know this, who has ever in his life tied up an arm for bleeding, where he must have observed the artery beating strongly only where it is undivided, where it runs in one trunk under the median basilic vein. Dr. Hunter's reasoning is even more mistaken than his assertion; for if in most people the artery divides a little below the place where we bleed, it matters little whether below that point the two branches be superficial or deep, the aneurism cannot happen "oftener to one of the branches than to the trunk*."

The more we investigate these arteries and their inosculations, the greater reason shall we find to trust even in their slenderest branches for the nourishment of a limb. Surgeons have been ignorant of this property of the circulating system. It is by neglecting anatomy that they have found it difficult to imagine, a priori, how a limb should be saved after its great artery is wounded, and they never could deduce such a conclusion from practice, for a reason which I am now going to assign.

It often happens that a limb is cruelly wounded, and its great artery at the same time cut across; this appears as the most fatal accident, and, from the moment that the surgeon knows of the wound of the main artery, that alone dwells upon his mind. He announces to the relations of his patient the danger of gangrene, and when the gangrene does come on, he ascribes it to the cause which is usually assigned, the mere wound of the main artery, without attending to the complicated nature of the case! The wound is of great extent; the limb is bruised, and, almost from the first moment, in a state of gangrene; the bones are broken, and the blood of the great artery driven deep among the disordered and lacerated parts. The limb perhaps is wounded with a ball, but still the wound of the great artery alone dwells on the surgeon's mind; he forgets the disorders and natural dangers of a gun-shot wound or compound fracture, and imputes the gangrene merely to the wound of the arterial trunk.

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* Notwithstanding my brother's criticism, I believe Dr. Hunter to be quite right. The radial artery coming off high, and running superficially, is pricked where it is under the vein, and forms an aneurismal varix.

The condition of such a limb is very different from what is usually supposed: when the artery is wounded, tied, and the blood interrupted, it is imagined that the limb is deprived of blood; that it dies of immediate direct gangrene; that the gangrene is from the want of blood! But it is quite otherwise; the whole arteries are thrown into the most violent excitement; the limb is gorged with blood; its arterial system works with uncommon impetuosity; every twig is dilated to carry its proportion of the interrupted blood; and if to this gorged condition of the limb are superadded such injuries as proceed from the passing of a waggon-wheel over the limb, a gun-shot wound, bruised flesh, and broken bones, there cannot fail to happen a very sudden gangrene, but not without a previous stage of inflammation, and the highest possible excitement of the limb.

[I beg the reader's attention to this pathological remark. It is by far the most important in reference to the practice of surgery in cases of wounded arteries, and the operations on aneurisms.

If an artery be struck and tied (and it must be tied above and below the puncture), the limb will be safe if the wound be not large: but if the wound be large, or if the parts have been bruised, or if it has been a gun-shot wound, then the case is quite altered, there is the most imminent danger of mortification. What is the reason of this? there can be nothing different in the condition of the main artery? No; the difference is in the condition of the branches of those inosculations, in the activity of which the circulation to the inferior parts of the limb now depends. When there is not much injury to the limb, there is not much inflammation and tumefaction ; but if the injury be great, and the swelling great, then the branches suffer compression by the fluid extravasated into the cellular texture. They are not permitted to act freely, and cannot take up this new office of conveying the blood to the extremity.

Hence it is that the most favourable circumstance in an operation for aneurism is a small, neat incision, direct upon the artery, so that the artery is tied without much injury to parts generally. But if, on the contrary, there have been long and repeated incisions and fingering, and injury of the deep parts, there arises an inflammatory tumefaction of the limb, which is attended with vesications and gangrenous spots, and the life is perhaps sacrificed.]

Much of our practice depends on this doctrine, which I shall afterwards explain more fully ; at present I would only remark the nature of the deception to which the surgeon is so much exposed.

If a man will look only superficially on these matters, or will be satisfied with general conclusions deduced from the accidents of only one particular case, then indeed he will be hurried along into this rash practice of cutting off arms as well as legs : or, in other words, if to establish this rule of surgery nothing more were required than an authentic case of a wounded axillary artery, followed by gangrene and death, such proofs might be found in every common book. Thus Mr. Gooch tells us, p. 76. " That he was called by a neighbouring surgeon to attend along with him a man who had been just before, in a state of excessive intoxication, thrown from his cart, the wheels of which had passed over the top of his arm and shoulder, bruising all the parts quite up to his neck, while an iron hoop, projecting from the cart, had cut him under the arm, tearing fairly across the artery and all the great nerves which go down along the arm."

"The limb was wholly deprived of sensation and motion, they felt no pulse at the wrist, and they concluded that the brachial artery was divided, although the bleeding, which was at first profuse, had stopped, partly by the retraction of the artery, and partly by their having tied down his arm to his side."

"Had not the drunken condition of the patient, and the violent contusion of the parts surrounding the joint, discouraged us," says Gooch, "we should have proposed immediate amputation at the joint. The next morning the arm appeared in different parts discoloured, emphysematous, and gangrenous; by noon it was totally dead and insensible to the finger ends; and on the third day, towards the evening, the patient expired. The day after his death, the arm was so thoroughly putrid that we were unable to dissect it, till after having washed it well with warm vinegar and spirits, we opened it, and found the bundle of the great nerves entirely cut across, and the artery also divided, and its upper end retracted an inch into the axilla." But this, far from being a general proof, is an accident merely: the death of this person is explained by the general circumstances of the case; the inebriation of the patient, his loss of blood, the cutting of the whole bundle of axillary nerves, are of themselves sufficient to account for his death. Perhaps he died as Captain M—— did (whose case is related by the celebrated Mr. White), rather from his inebriation, loss of blood, and wounded nerves, than from the necessary consequences of his wound; for Captain M——'s arm preserved its circulation; its heat had returned; the vein swelled upon putting a ligature round the arm; he died after the arm was safe from all the consequences of the tying the artery *.

But this case, related by Mr. Gooch, was complicated with other accidents; for we are told that they were deterred from amputation by the bruised condition of the parts surrounding the joint. The wheel had passed along the arm and shoulder quite up to the neck; these parts were black; and, I dare say, little better than gangrenous: is it at all surprising that an arm so mangled, upon a body so hurt and disordered, fell into immediate gangrene?

Hence we see the folly of deducing any general conclusion from an individual case, and we are reminded of this good rule in philosophy, that one positive evidence must outweigh any number of negative proofs. If we can find but one single example of an axillary artery wounded, and the arm saved, it is then a settled point, that in favourable circumstances the inosculating arteries round the shoulder will save the arm; and the conclusion will stand

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* My brother is here losing sight of the leading principle, which is this, that when there is a large wound, and the parts bruised, conjoined with the obstructed trunk, the limb must mortify. The division of the nerves will not cause the mortification.

firm; though there should be produced against that single recovery a whole host of negative proofs, they will signify nothing. It evidently becomes our duty, whenever we are presented with a case seeming to contradict this positive proof, to inquire into the circumstances and accidents which have made that one case fail, while another operation has been followed by such perfect success. As the purest case, the least complicated, and the most unequivocal example of success, I put down the following:—

"About sixty years ago, Mr. Hall was called to a man in Cheshire, who had received a very considerable wound, just below the axilla, by a scythe, which had divided the brachial artery. The man soon fainted away with the loss of blood, which preserved his life, as nobody was near him. Mr. Hall, being only accidentally in the neighbourhood, had no needles with him; but as soon as he arrived, he easily laid hold of the artery with his finger and thumb, till he could procure some thread, which he immediately tied round the vessel, and effectually secured it. The man recovered the use of his arm; though he had ever after a weak and trembling pulse *."

It was the broadness and openness of this wound that enabled the surgeon to see the bleeding artery, and to take it up so fairly, as to save at once both the life and the limb of the patient; for in many other cases, it has only been by consenting to lose the limb that the patient has saved his life; or where

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* Vide White's case of Captain Mounsey.

the limb has been saved from amputation, it has in general hung, shrunk, lifeless, by his side *.

If it were worth while, I would carefully explain the chief accidents of this kind, so as to prove the following positions: That the wound of the axillary is less dangerous still than wounds of the femoral artery; that when gangrene has seemed to proceed from a wound of the axillary artery, it has been owing rather to the complications and accidents of the case; that when, together with a wound of the artery, the bones are fractured, or the soft parts bruised, as with a waggon wheel, the cure will be almost impossible, and the parts must fall into gangrene; that where,

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* It was more than suspected more than a hundred years ago, that in aneurisms of the brachial artery the vessel might be tied even in the axilla, without danger of gangrene. "Imo posse constringi filo truncum arteriæ axillaris, supra præcipuas illius bifurcationes si inibi aneurisma excitatum fuerit, procul a metu necrosis membri subsequuturæ vel alterius symptomatis; id quod postremo notum esse volui Dom. de Bligni et aliis."—Morellus, Nosodochii Charitatis.

Thus, the communications of Sharp, Chesselden, and Le Dran, on this subject, lose much of their value. This was not a mere doctrine; the theory thus delivered, and indeed anxiously inculcated by Morellus, was backed with facts. The following case is remarkable: "A young man having been wounded in a duel, on the fore part of the arm, had the artery and vein cut across near the axilla. The hæmorrhagy was dreadful, and knowing well that it could not be repressed by astringents, I had recourse to the ligature, in the following manner: I passed a large crooked needle through the sound part above the wound, driving it so deep that it went close to the bone; it pierced the long extensor (viz. the long head of the triceps), and it passed through the belly of the biceps on the fore part of the arm. The ligature was very strong; so placing a compress on the skin to prevent it cutting, I drew it hard, till it fairly compressed the artery and vein. There was no further hæmorrhagy, and the man did well." Though this be but a coarse business, yet the success is flattering, and is good evidence on this interesting point of practice. The case is related by Mr. Samuel Formi, a surgeon of Montpelier.

by the force of the artery driving the blood inwards, the cellular substance and the interstices of the muscles are filled, or (as I may say, rather) injected with blood, we shall have a slow and tedious cure; that if the inosculating arteries be torn in a lacerated wound, or their circulation disordered and interrupted by a high inflammation and swelling of the parts, that also will make a very doubtful case, and in those circumstances it must be dangerous to attempt the cure. But all these do not belong to the general question; they are merely the peculiarities of the individual case; they are indeed the very points to be debated in any great consultation; but they are not arguments for a general rule. Let, therefore, the surgeon do as he sees prudent in cases of wounded arteries, with lacerated flesh, broken bones, a disordered system, a weakly habit of body; but on no account should he allow himself, in a simple wound of any great artery, even to consult about cutting off the limb.

From this pitiful timidity, the most horrible, and, I may say, unnatural things are done; a man having an aneurism is absolutely allowed to bleed to death, after nature, unassisted and alone, has almost accomplished the cure.

* "A soldier of the 3d regiment of Foot Guards perceived a swelling in his axilla, for which he could assign no cause. The surgeon of his corps knew it to be an aneurism. The tumour increased slowly for nine or ten months. His surgeon, unwilling to adventure upon a desperate operation, had him con-

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* For the following case, see a paper on Aneurisms, by Dr. Monro, Edinburgh. Essays Physical and Literary, vol. iii. p. 196.

veyed to St. George's Hospital. The tumor then had acquired a very great size, had extended itself from the axilla far down the arm; it still had some pulsation, but the pulse at the wrist was weak and feeble. 'The regimental surgeon, and the physicians of the Hospital, thought the tumor was situated too high up to attempt any operation.' When they had pronounced this sentence of death, they recommended palliatives and anodynes.

"It was in October that he was conveyed to the Hospital; he lived on to the end of November or beginning of December, when the tumor began to rise in the middle, and at last it burst on the 29th of December, and the patient died of a profuse hæmorrhagy.

"Upon dissecting the body, the tumor was found to extend above two-thirds down the arm; the axillary artery opened into the sac, the artery itself being undilated and sound; the walls of the sac seemed to be continuous with the coats of the artery; the sac itself was filled with large lamellated polypous concretions; and, along with these, a quantity of fluid and grumous blood. The lower part of the humeral artery lay behind this aneurismal sac, and was quite impervious for half an inch; for, just below where the arterial trunk opened laterally into the sac, the continued trunk of the artery was quite obliterated by the adhesion of its sides."

From the circumstances of this dissection, we cannot doubt that the main artery was entirely obliterated. From its being closed by "an adhesion of its sides," we are assured that this obliteration of the artery had been slow and gradual. From "the rest of the humeral artery and the radial and ulnar arteries being still open, but much smaller than they commonly are in adult subjects," we are assured that the change in the circulation, so desirable, and yet so much dreaded, had actually taken place, the main trunk of the artery had been entirely closed, while the arteries below had been more sparingly filled by the inosculating branches. We are, moreover, assured (from the following observation), that the circulation through the inosculating arteries was fully established; that they had continued to support the arm for a month. "This swelling gradually increased, and its pulsation as gradually diminished, so that at last only a tremulous motion could be observed in it; the pulse in the wrist grew daily weaker, and at last ceased entirely; in the end of November, or beginning of December, the tumor began to rise in the middle, and on the 29th of December it burst, and he died of the hæmorrhagy."

What a sad picture is here of the state of surgical practice at that time in one of the principal hospitals in London! The tumor compresses the humeral artery two-thirds of its length; the tumor itself is obstructed with coagula; the tumor loses its pulsation, and the blood ceases to pass through the artery. Then the pulse of the wrist becomes small and fluttering, it ceases at last, and yet the arm continues to live; the process of obliteration is slow, but it is so complete, that the sides of the artery adhere, the arm survives this change in the circulation a whole month, perhaps more; and yet, when the aneurism bursts, the surgeons allow the patient to expire from loss of blood! What is our profession good for, if we are to allow such a patient to die? if we refuse a patient those means which Nature has appointed for saving life? Surgeons and physicians, deliberating with absurd formality about inosculating arteries, might resolve thus to let the patient expire, but his honest and ignorant friends would not have done so; with common sense only to direct them, and full of the natural feelings of humanity, they would have judged that nothing worse could happen him than to die, and would no doubt have tried to stop the blood!

CONCLUSION*.

Thus have I proved to you, that there are no arteries in any limb entitled to the appropriated name of Inosculating Arteries; that inosculation is a form and property of all arteries, essential to a free and perfect circulation of the blood: Whereas, surgeons have observed hitherto no inosculations, but those which are enlarged in aneurism; have known no inosculating arteries, but those from which they expect the safety of a wounded limb: They seem to have imagined, that nature has appointed particular inosculating arteries to nourish the limb, when they choose to perform their operations in the ham, or at the bend of the arm! never reflecting on the admirable wisdom with which all parts of the body, even the slightest and almost invisible inosculations of arteries, are made to contribute to its preservation.

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* In this edition I have omitted a dissertation on inosculation, as being more of a physiological essay, than strictly practical. It contains matter, however, of the highest interest. The conclusion to both discourses is here introduced.

Inosculations assist the free circulation of the blood, and allow of retrograde motions when required. Inosculations, by connecting many arteries, enable the blood to leave those vessels which are obstructed, or cut off, and serve to accumulate the force of many arteries upon that point where the vessels are particularly required to act. Inosculations increase all the powers of the circulation in the extreme arteries, and are multiplied in exact proportion as the arteries recede from the heart.

Inosculation endows the circulating system with particular aptitudes and powers; it is essential to free circulation, secretion, and nourishment, to the function of the glands and viscera, to the regeneration of parts that are destroyed, to the saving of parts that are injured; and this equable motion of the blood in every direction is essential to adhesion.

The power of inosculation knows no limits, but, like adhesion, is perfect in all parts of the body wherever vessels exist! no part of the body is lost for want of adhesion; neither can any part be lost for want of inosculation. Who could have believed that a bone could adhere to a bone? Who could have believed that the cornea, when cut open in extracting the cataract, or the crystalline humour when displaced in couching, could adhere to the surrounding parts? Who could have believed that the carotids could be stopped up! the aorta itself interrupted! the vena cava quite obliterated! the thoracic duct oppressed, so as no longer to transmit the lymph, without life being endangered? Who could have believed that the femoral artery, and all its branches on the fore part of the limb, might be obliterated, without the limb falling into gangrene? Surely I am entitled to that broad and universal conclusion to which I have laid claim.

This fear of interrupting the great arteries proceeded merely from ignorance of pathology. Reason and experience concur to prove that it is safe; and I feel myself entitled to lay down, at the conclusion of this discourse, a rule the very reverse of that with which it began. After these proofs, the questions about inosculations may be blotted out altogether. Wounds of the axillary artery, like wounds of the femoral artery, are often dangerous from secondary bleeding, but never fatal from the want of inosculations. We may tie the greatest arteries confidently, wherever they are wounded without the trunk of the body. We should tie as boldly the arteries at the groin or in the axilla, as in the lesser branches going down the thigh or arm. Accidents (as we are in all our operations at the mercy of accident) may undoubtedly prevent our achieving a cure! A limb bruised with a waggon-wheel, or wounded with a great ball, cannot be so easily saved, as when the artery alone is wounded by the stab of a knife or sword. Yet although the accidents and dangers of gangrene were multiplied tenfold! this common reason for cutting off the thigh, or amputating the arm at the shoulder joint, should be abandoned; it is bad doctrine and cruel practice.

[In considering this admirable discourse, every one with the slightest tincture of science, or capacity for it, must be struck with the evidence it affords, and satisfied of its great importance to every branch of surgical practice. I am tempted to say, that if it had been written in a duller manner, and with less force of language, it would have been supposed deeper and more philosophical. The command of language, and the ease with which an author offers illustrations, may incline weak minds to believe that his writing is without effort, and struck off as a rhapsody; whereas it is deep, well reasoned, and very extensive in its consequences.]

DISCOURSE V.

THE HISTORY AND CAUSES OF ANEURISMS*.

"Would you know," says the celebrated Guattani, "how I was inspired with love for my profession and enthusiasm in study! I will relate the manner of it very willingly, for, in truth, certain accidents which struck my imagination early in life were the cause. †First, A bailiff who had been shot with a pistol in the bend of the arm, was laid in the hospital of the Holy Ghost, where, for seven days, his cure proceeded with every favourable sign; but would you believe it! on the morning of the eighth day when I went to visit this man, the attendants met me and told me he was dead? This unaccountable and sudden death induced me to dissect the body: I found the side of the artery open, and the eschar which the ball had produced partly adhering, partly separated, no bigger than a grain of corn; it was by the sudden yielding of this eschar that he lost his life! Almost on the same day, another whose artery had been pricked in bleeding, died of the hæmorrhagy without even an attempt to save his life! Another whose aneurism was in the ham, had a caustic applied to it, and when the eschar fell off he bled to death! Another still had his aneurism opened with an actual cautery, and immediately expired from loss of blood! To these dismal scenes which I myself have witnessed, what numbers might I not add from the consultations and writings of others!"

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* The discussion on the various modes of restraining hæmorrhage, and the rules for the treatment of wounded arteries, and of aneurism produced by wounds, have been in this edition given in the first volume. The present discourse includes the Pathology, being on the History and Causes of Aneurisms. But the reader should, at the time he reads this, refer to p. 273, vol. i.

† This is not a literal translation of the text of Guattani: these accidents awakened in him, not this general love of study, but a particular desire to study aneurism. "Quod si scire aves, inde in me originem duxerit prurigo in universa chirurgia quæ tam longe lateque diffunditur, hanc unam excipiendi græmio, serioque excolendi materiam."

If you, gentlemen, have not yet witnessed the uncertainty that prevails in consultations about aneurisms of the great arteries; the hurry, confusion, and dismay, so legible in every countenance while the bloody operation is performing; if you have not, when the unhappy patient has been left to his fate, observed the pulsation increasing from day to day, nor felt the awful throbbing, nor seen the blood welling out through the cracked, livid, and gangrenous skin, preludes to that last torrent by which the man is to expire! if you have not yet seen the affecting situation of such a patient beyond the reach of help resigning himself to his fate, you cannot feel all the importance of this subject.

I will boldly neglect those insignificant definitions which never can circumscribe a subject like this, definitions such as no sensible student will value, nor any wise teacher attempt; and proceed to give you a full and plain history of aneurisms! For decision and judgment in operating or in consulting, depend not on curious and nice distinctions, but on universal knowledge. I will endeavour therefore to disclose to you the true principles of pathology, to lay before you all the materials for further study, to teach you habits of reflecting and deliberating upon the nature of this disease.

DESCRIPTIONS OF ANEURISMS.

[It will be of great advantage to the reader, of whatever age or state of advancement in his profession he may be, to peruse diligently the following dissertation on aneurism. If he be a superficial reader, he will declare it tedious,—if he love his profession and is pleased with that exercise of mind by which the operations of the common surgeon are directed, and if, above all, he be desirous of seeing how the farther improvement of surgery is to be prosecuted, he will peruse these observations with singular interest.

Certain passages in these pages seem to declare that my brother did not know the exact fact,—the distinctions of aneurisms; for he speaks of dilatation in contradistinction to rupture of the coats of the artery.

Yet, on the other hand, he arranges his proofs, and states his argument so well, showing that a suplimed ruptured artery may produce a tumor of regular form and slow growth, that it is impossible to say he was ignorant of the truth. His explanation, too, of the effect produced by the cellular membrane which surrounds the artery, the mixing of the coagulum of blood with the cellular membrane, so as to form a barrier to the escape of blood from the torn coats, and of the condition and effects of the coagulum,—is so well given, that we cannot say he was ignorant of the modern doctrine of aneurisms. That the reader, while he follows out these important narrations, and the reflections they call up, may be able to embrace the whole subject, I shall place before him some further conclusive evidence on the subject of aneurism.

The expression of true and false aneurism is still used, when there is no corresponding distinction in reality. Originally, it was intended to say, that an aneurism might be formed by dilatation of the coats, or by rupture of the coats. If we put aside the distinctions of writers, and ask what differences are presented in practice and actual experience or observed in dissection, we shall be constrained to say, that an artery may suffer a certain dilatation; but then it does not constitute an aneurism,—the circulation is not interrupted or disturbed, there is no clot and no danger, while there is dilatation only. The error has arisen from contemplating the exterior surface of the aneurismal tumor; for the coats of the tumor may appear quite continuous with the coats of the artery, although, in fact, there has been a rupture of the coats; this rupture is generally very distinctly seen, when a section of the tube of the artery is made, and its inner surfaces examined.

The natural and spontaneous aneurism is therefore nothing more than an aneurism from rupture forming slowly; and the process of its formation is well described in the present section of the volume. I have specimens where the sac first formed has burst, and a second has formed exterior to the first. But if the artery burst suddenly and violently, or if the sac already formed is burst with violence, then the blood gets abroad, and there is no sac nor wall built up, and the aneurism is called diffused; thus it is that a true aneurism may become a diffused aneurism by the bursting of the sac; and this is no uncommon occurrence, when aneurisms are permitted to take their course.

In the sketches illustrating the effect of the sheath of an artery, in the formation of an aneurism, fig. 3. (p. 373.) does not represent the matter exactly as it occurs; for the sheath is never so stripped off the proper coats of the artery, nor does the artery lie insolated in the sac, as it is there represented. The tumor of the aneurism is formed on the side of the opening, and the artery itself is pressed back, and incorporated with the walls of the sac.

An artery may be so wounded, as to produce an aneurism, differing in no essential circumstance but in the cause; in the one instance, it is a rupture from disease, in the other it is a puncture. But if the puncture be small or oblique, and if, in consequence, the blood is not permitted to escape suddenly, but only to ooze out and coagulate in the cellular membrane and sheath, a regular circumscribed and sacculated tumor forms gradually. If, on the contrary, the wound be large, then the blood escapes and is diffused; and so it may happen from disease and rupture; for if the rupture of the artery be large and free, the cellular membrane will not arrest the blood sufficiently to permit the coagulum and sheath to be baked together. The blood will spread abroad into the interior of the limb and among the muscles, and it will be a diffused aneurism.]

Aneurism, when it arises without blow or hurt, steals on slowly. A small tumor is felt, for instance, in the ham: it is small at first and firm, and but little affected by the pulsation of the artery. It lies deep among the flesh, and must be felt for by working in the fingers and pressing aside the adjacent parts. It is supposed to be a knot or kernel, has little pain, is neglected for many weeks, and might be mistaken even by a surgeon for a swelled gland. This little tumor grows, and beats more strongly, but an ignorant and hard working man is not easily alarmed, nor willing to forsake the daily labours by which he provides for his family. Still the tumor beats strongly, and the patient is at times alarmed; there is an unaccountable heaviness, pain, and numbness through all the limb, and by those shooting pains and this heavy lameness, he is obliged to ask advice. The surgeon, with marks so decisive as these, knows this throbbing tumor to be an aneurism; he offers the man his assistance, begs him to submit to regimen, low diet, confinement, and a gentle bandage; he advises him to go to an hospital, but the patient is unwilling to think thus seriously of his disease.

From week to week this poor man works and rests alternately, is careless of the limb, still hoping that it is but a slight complaint, till at last by pain and lameness, he is confined to bed; and by the intense throbbing he is truly alarmed. The surgeon, now called again, is also seriously alarmed; he finds the tumor throbbing strongly, increasing rapidly, beginning to fill up the cavity of the ham, yet too painful and too much inflamed to suffer compression; but while he is hesitating what to do, or whether an operation may be proposed, it often happens that a second aneurism begins to form in the other ham.

In a few weeks this ham also is distended with a hard, firm, and throbbing tumor, hard as a stone, and rising strongly with each pulse of the artery. The leg becomes œdematous, the thigh swells, the whole limb becomes heavy, cold, and pulseless: perhaps the pulsation in the tumor ceases, but the parts still continue thick, the tumor firm, but not yet threatening to burst. After some weeks of suffering, another tumor appears in the opposite thigh, and as if from the greater power of the femoral artery, or from the whole arterial system being predisposed to disease, this third aneurism increases with a rapidity wholly alarming. Which of these great aneurisms shall burst and be the cause of death, seems long doubtful, till, as if the greater aneurism of the thigh had drawn off the blood to itself, the progress of the original tumor is no longer observed, the aneurism of the thigh increases from day to day, and the patient, now weakened by many months confinement, is quite exhausted with pain and fever, and constant suffering. If he survive, the greater tumor becomes livid, the skin becomes thinner from day to day, but not softer, it is parched and hard as if from want of nourishment, it cracks and scabs, and then blood issues through the crevices. For some days he is sensible of approaching death, and asks for opiates that he may die quietly; at last the blood bursts out, he immediately faints, but is saved from this first hæmorrhagy; he falls low, is seized with sickness and vomiting, a low delirium comes on, and the next morning, after a slight discharge of blood, he expires.

How can we doubt that this is truly a spontaneous aneurism proceeding from a disease of the whole arterial system which needs no exciting cause, when tumor rises after tumor, in the ham, in the thigh, in the groin, without any obvious injury* ? Such tumors begin during sickness and convalescence, while the patient is in a state of perfect quiet, and while there is not even the slightest fever to account for this dilatation of the artery; but if doubts concerning its nature remain, we generally find them all resolved by the dissection of the body. These successive aneurisms are found to be true dilatations of the artery; there is no breach of the arterial coats, the cellular, the muscular, the villous coats are thickened as they approach the dilated part, and may be fairly traced over the aneurismal tumor: it is on the tumor indeed that the several coats are most distinctly traced. But strong as this predisposition is, we are astonished to find these dilatations end gradually and gently in the sound artery, which has in the intermediate parts not the slightest mark of disease, the arterial system being throughout limber, soft, and natural.

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* During the operation for aneurism on the extremity, the patient has died suddenly from the bursting of the aorta! This happened to a patient of Sir A. Cooper. He sent me a portion of the artery; and at present there lies in the Middlesex Hospital a man, who, while under cure by operation, has another tumor forming in the other ham.

But aneurism often arises not only from this inscrutable predisposition, but from an actual and manifest disease of the arterial system. We find throughout the arterial system, the coats of the arteries thickened and brittle, their cellular substance loose and spongy, with spots and specks of ossification besetting the great arterial trunks. We find the great arteries dilated where they give off their larger branches, and the arch of the aorta or beginning of the subclavian arteries in an aneurismal state, while the lower part of the aorta is small, crooked, and irregular. These are the marks of a disease which prevails towards the decline of life; it is often observed before the fortieth year; but it is singular, that till the approach of that period of life, natural aneurisms are extremely rare: Aneurisms are rare in women, indeed they are seldom heard of in that sex; they are frequent in strong and hard-working men, but in them also they rarely occur till after the thirtieth year, when their arteries begin to acquire this hard and rigid condition. At that period of life, in laborious and hard-working men, the joints are not stiff nor their muscles shrunk, they feel strong and healthy, they are in the habits of strong occasional exertions and continual labour, they are accustomed also to violent actions of the limbs, such as their arteries are but ill able to bear. In short, the defects of old age have come upon the arteries sooner than upon the rest of the system; the arteries are unequal to those exertions of which the muscular frame is still capable, one part of the system is weakened before another, which is the very essence of disease, or predisposition to disease.

Yet this predisposition is of such a nature, that it seldom degenerates into aneurism without some direct violence. In all parts of the body there are weaknesses and imperfections which we are made sensible of only by the part being hurt. Aneurisms of the limbs are seldom known in women; their system is lax, and what is more favourable, they are exempted from those exertions by which the arteries are often injured or burst. Aneurism is rare in young men, and frequent in the middle stage of life, when the arteries become harder, when the muscular strength is unabated, and the occasional exertions of the limbs very violent. Aneurism is almost peculiar to men in the lower ranks of life, to soldiers, porters, labourers, miners, and those who work at laborious trades; it is particularly frequent in postilions, troopers, and the drivers of stage coaches; and though the tumor has at first all the signs and appearances of natural aneurism, yet there are few of those enlargements of the artery which cannot be distinctly traced to some external injury, some blow, sprain, fall, or violent exertion of the limb! There are few, indeed, that do not immediately and perceptibly follow the injury. Often, I am persuaded, the artery is not merely injured, but absolutely burst or broken across! Aneurism of the ham is more frequent, in consequence of the artery at that part lying close under the knee joint, bending over the condyles, and bound down by the heads of the gastrocnemii muscles, whence it is endangered by every sudden motion of the joint, and affected by every strain of the limb. Aneurism is frequent also in the thigh, in consequence of the length and great size of the femoral artery, its oblique course round the thigh, its passing through the tendon of the triceps, and from the manner also in which it is braced down by the muscles. The operation of these various causes of laceration must next be explained.

An artery such as I have just described it, rigid and diseased, an artery which tears under the surgeon's ligature, which bursts upon injection, which, in dissections, feels so palpably hard and brittle, is not surely calculated to resist violent strains or sudden motions of the joint; and accordingly we sometimes find an artery perceptibly lacerated by external violence and sudden bending of the joint, just as it might be broken across with the finger and thumb in dissection.

"Three years ago," says Walther, "I had the long wished-for opportunity of dissecting an aneurismal limb. An old man about fifty years of age, of a constitution naturally hale and vigorous, was confined to his bed, crooked with rheumatism, and tortured with pains in his knees; his left knee especially gave him great distress, "Chiragra fregerit articulos veteris ramalia fagi." This miserable creature being wretchedly poor, instead of sending for better assistance, applied to an old woman, who, having first extended his crooked knee very violently, wrapped it up in some of her plasters. This extension of his knee was extremely painful to him, and he soon perceived a small tumor upon the popliteal artery; it pulsated very strongly, and upon the slightest pressure produced exquisite pain. This aneurism gradually increased to an enormous size, and it was only when the poor man became sensible of having no other chance for life, that he submitted to amputation."

"The limb was immediately carried to Walther's rooms, where, upon dissection, it was found, that the popliteal artery was dilated into an aneurismal bag of a heart-like shape, of three inches broad and four inches long, occupying the main artery from a little below where it gives off its two upper articular arteries, to within an inch of that point where it divides into the tibial and fibular arteries. The heads of the gastrocnemii, solæi, and plantar muscles, where they covered the sac, were extended to a remarkable degree of thickness, and the great vein and nerve raised by the tumor, were protruded betwixt the two heads of the gastrocnemii muscles, so as to be in close contact with the skin."

In the drawing of this aneurism by Walther, which is indeed very beautiful, we see osseous concretions occupying the coats of the tibial and fibular arteries below the aneurism. We have every reason to presume, that in the ham, and in the upper parts of the femoral arteries, these specks of ossification must have been much broader and more frequent. These ossifications are the surest marks of this brittle unyielding state of a great artery. The "veteris ramalia fagi," the crooked and knotty branches of an exhausted tree, may serve as an apt emblem of this artery, rigid, unyielding, and brittle, and we have no reason to wonder at the effects of the quackish old woman's extending the contracted joint thus suddenly. An artery must, like the ligaments and other parts, where the joint continues for any length of time thus crooked and stiff, be proportionably shortened, and an artery in this brittle state must be unfit to bear sudden extension. In this instance, some of these brittle ossifications had given way or hurt the adjoining parts, the remaining coats of the artery had dilated into a true aneurism, the artery certainly had been injured, though not entirely lacerated, for the drawing represents a true aneurism, a sac entire and continuous with the arterial coats.

But the aneurism often so immediately succeeds the blow or fall! the tumor, the pain, the lameness so instantaneously follow the injury done to the artery, that we can have no doubt of its being absolutely lacerated so as to produce a false aneurism, I mean an immediate extravasation of blood, and not a mere dilatation of the arterial tube.

John Robertson, a carpenter, a young man in full health, who had never felt the slightest uneasiness in his thigh, in whom there was no reason to suspect any previous disease, got very drunk and fell several times in the streets. Before the third day, he began to perceive a swelling in the middle of his thigh, which had a strong pulsation, and was very painful, and by the eleventh day both the swelling and pain had increased considerably. He was then conveyed to St. George's Hospital, and on the twelfth day the surgeons held a consultation on his case. "They were of opinion, in one voice, that this was a false aneurism occasioned by the rupture of some large artery; that the aneurismal sac ought to be opened, and, if the ruptured vessel was found to be only a collateral branch, that it ought to be tied, but if it proved to be the trunk of the crural artery which was ruptured, that the amputating the limb was the only method to be used! to save the patient's life. The sac being opened, it was found to be actually the crural artery which had burst, the limb was amputated accordingly and the man survived*."

In the natural or spontaneous aneurisms which I have hitherto described, we see the slow dilatation of an artery. The tumor is at first without pain, small, firm, and to be felt only by working the fingers deep among the flesh of the thigh. At first it is not to be distinguished even by the surgeon from a small lymphatic tumor receiving the pulsation of some contiguous artery, and such tumor increases for months before it assumes the pulsation, pain, and other characteristics of an aneurism. But when, as it often happens, a man in the very time of falling, as in the instance of a blow, or sprain, feels pain in the ham†; when he observes that he has from that moment considerable pain in laying his leg across; when, on the third or fourth day he feels distinctly the pulsation, pain, and lameness, which are the peculiar signs of aneurism, what reason can there be for doubting that the artery is burst? None, surely, but the slowness with which the aneurism grows. The slow manner, then, in which even the greater arteries of the body form their aneurism must next be explained.

We are naturally inclined to believe that an artery thus broken or lacerated must form its aneurism the moment its coats give way, and must be able to overcome all resistance from the surrounding parts in a few days! But here we are deceived; we must not regard the artery as a naked and insulated tube, such as is here represented, merely laid along the limb, unconnected with the surrounding parts, unsupported by cellular substance. The artery has a cellular coat in which it is lodged; this coat is so peculiar as to be called the sheath or capsule of the artery, and is closely connected with the proper coats of the artery by cellular substance and numerous vessels, which strengthen, support, and nourish it; and when the proper coats of an artery are torn, the blood is not widely extravasated, but is confined by this sheath of cellular membrane, which is very slowly forced or separated from the artery. Even after the sheath is separated from the artery it does not entirely give way, but its cellular substance is kneaded as it were with the half coagulated blood, and rises into a tumor somewhat resembling the thrombus which rises over an ill closed vein.

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* Physical Essays and Observations of Edinburgh, Vol. III. page 217, 218.

† This man felt no pain in the moment, because he was drunk.

Fig. 1.

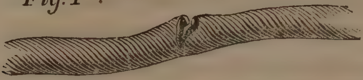


Fig. 2.

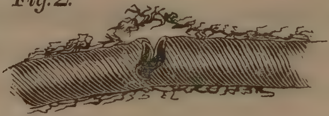


Fig. 2d represents the true and natural condition of the artery which is every where nourished by its cellular sheath, and represents a laceration or rupture of the artery, showing how the sheath and cellular substance is opposed to the exit of the blood.

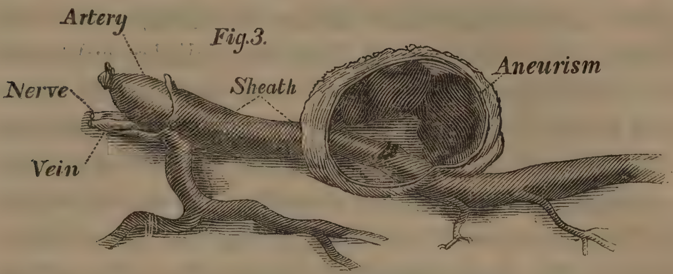


Fig. 3d represents the aneurism already beginning to form. Here is once more represented, the continued sheath within which the great artery is enclosed ; large branches, such as the profunda femoris, and smaller muscular twigs, are marked going off from the great trunk, each having its own peculiar sheath. For the smallest arteries are as well supported with cellular substance, and have sheaths as peculiar as the femoral or carotid arteries ; each little artery, as it penetrates among the muscles, is enclosed along with its corresponding vein, and often with a small twig of a nerve, in a peculiar fascia. Aneurism produced by the bursting or laceration of an artery dilates slowly, because, the continued canal of the artery is still open to the blood, the cellular substance yields very slowly, the blood coagulating in hard and firm clots walls up the artery, and is so mixed with the first lamellæ of the cellular substance, and is so firmly clotted as to make a strong resistance. At first, while the blood is confined to its natural course, the progress of aneurism is slow. But when the cavity of the aneurism is enlarged, when the blood begins to collect there, and the circulation becomes irregular, these clots give way from time to time, and by exercise, working, or accidental excitements, there is from time to time a new impetus against the sides of the sac itself, and it enlarges; the clots which line the cellular substance become bigger and firmer; layer is added to layer, and at every addition of this kind, the fluid contents of the aneurism accumulate, the open part of the bag enlarges, and the cellular sheath of the artery, which in fact corresponds with that in Fig. 2d, is condensed into a firm aneurismal sac, which gives the whole tumor sometimes the appearance of a spontaneous and natural dilatation of the artery itself. Thus there is formed a great tumor of clotted blood, surrounded with a firm cellular sac, and bounding a cavity which is continuous with the artery, where the circulation of the blood is irregular, and often accompanied with a whizzing noise.

This hard and firm tumor, rising higher and higher over the artery, begins at last to compress the canal of the artery itself; the clots sometimes loosen, fall down, and almost choke the current of the blood; the limb grows cold and benumbed, from the compression of the great trunk, and it swells and inflames from the enlargement of the inosculating arteries. By the perpetual and increasing pulsation, the pressure and straitness increase, the bones are spoiled within, and the integuments are almost destroyed without; the limb is safe, for the inosculating arteries are enlarged, yet, when the tumor bursts, the patient dies from the bursting of the main artery, and the immediate loss of blood.

Thus we perceive that the increase of such an aneurism, where the artery is absolutely broken across, is naturally slow; that the resistance is uniformly great; that the artery does not lie as in our preparation glasses, or on the dissecting table, insulated and unconnected, but is surrounded with cellular substance; its rupture is walled up with coagulated blood; its canal is open to the circulating fluids, and there is, for a long while, a firm pulse even in the artery which is desperately wounded, provided it be not entirely cut across.

While I relate the following case to you, you will expect, from paragraph to paragraph, a description of a dilated artery, an aneurismal sac, and a bursting of the aneurism; but the disease proceeded merely from a laceration of the artery, and the circumstances of it are of the most interesting nature.

"A young man of about thirty-seven years of age, of a lax and delicate constitution, a tin-worker, had used this trade from his childhood, had frequent occasion, in beating and melting the tin, to remain long at the furnaces, or under ground; was much addicted to venery; had been poxed from his earliest years; was a keen hunter, and was wont to go out with the nets, regardless of hours or seasons. This man had for many years pains, which he chose to call gouty.

"On the first of November, 1742, while straining under a load, his left foot slipped; he made a sudden effort, and tried to support himself with his right leg, but instantly felt such pain in his thigh, that he fell down and fainted.

"Proper remedies were applied, and though he never after walked firmly on that leg, yet he passed the spring and succeeding summer tolerable free from pain. But in the following November the disease returned, pungent pains shot along the thigh and leg, and those which passed from the ham to the foot were peculiarly severe.

"An apothecary who was called in, prescribed the usual fomentations and ointments for this excruciating pain; but when he began to observe a firm tumor above the middle of the thigh, and of considerable size, he desired that a surgeon might be consulted: But the patient consulted a priest, who, esteeming the complaint a very slight one, promised to cure him. The disease (says Guattani) increased, and I was called to visit him on the twelfth of November. Upon examining the thigh, I found the tumor or hardness prominent, circumscribed, irregular, and pulsating, but still of the natural colour of the skin.

"I could not be ignorant that this was as an aneurism. I straightway explained the nature and importance of this disease, advised that some other surgeons should be consulted, prescribed a regimen, and applied simple ointment to the tumor. The celebrated Joannes Victorius Masini, my ancient and respected master, was called, who, agreeing with me entirely, ordered the bowels to be emptied, and some blood to be taken from the arm; his directions were immediately fulfilled, the whole thigh being at the same time anointed with ointment of roses and althea."

You will notice now the commencement of one of the most extraordinary appearances in aneurism that has ever been related; for at this period the aneurism burst out among the cellular substance; and, by successive impulses, burst again and again, with a sense of laceration from time to time, during the night.

"On the fifteenth of November, about three in the morning, the pain became exceedingly violent, and before four, the whole thigh was swelled, with such increase of pulsation and pain, that the man was in torture. At four in the morning, he felt suddenly as if something had burst in the most prominent part of the thigh ; it seemed to him like the splitting and tearing of new cloth ; along with this sensation came on excruciating pain, which raged for a full hour. At nine he felt, in the same spot, a second yielding and sense of laceration, slighter than the first, accompanied with a slight degree of pain, which soon subsided, and at the distance of four hours more, he felt the same sensation a third time, but slighter than either of the former.

" In the morning (says Guattani) I was informed of these circumstances ; I found the thigh swelled to twice its natural thickness, with a painful distension of the limb, and such hardness as entirely prevented the pulsation.

" On the nineteenth of November, soon after my morning visit, he fell into such excruciating agonies, that his attendants thought him expiring ; but in an hour after his pain was remarkably abated. Towards evening I could perceive that the upper tumor had extended four inches upwards, towards the origin of the Sartorius Rectus and Vastus Internus muscles, with tension and distinct pulsation, and I apprehended that, besides blood, it contained no small quantity of air.

" The next day he was indeed somewhat relieved of the pain, but was extremely weak, wherefore I ordered them to administer extreme unction, applied a mash of leeks and vinegar to the tumor, but, though this application had its effect, the pains, after some hours, increased; the patient, of his own accord, had recourse again to the softening ointments, but without effect; he continued during the night pained and delirious, and frequently imagined that he felt something rising from his thigh to his heart.

"The next morning, though his pain was less, his pulse was sunk, his face was death-like; and, after some tremulous motions of the limb, and slight convulsions of the whole body, he expired.

"On opening the abdomen, I found the ilion considerably inflamed; I then dissected the artery backwards, along the haunch bone, to the ligament of the thigh, and cleared it of the gangrenous peritoneum with which it was covered; and then laying open the femoral ligament and the teguments of the groin, I continued to dissect along the course of the artery, clearing it of the surrounding parts, till I arrived at the tumor, which was but a very little below the groin. After dissecting the tumor carefully, I found it to consist of grumous blood, to the amount of three pounds and a half. This extravasation lay in the interstice of the muscles, in the bed of the great vessels. It separated the sartorius and triceps from the Rectus Cruris, and extended along the whole thigh from the groin to the knee. This blood being cleared away, the artery appeared lacerated nearly to the extent of two inches.

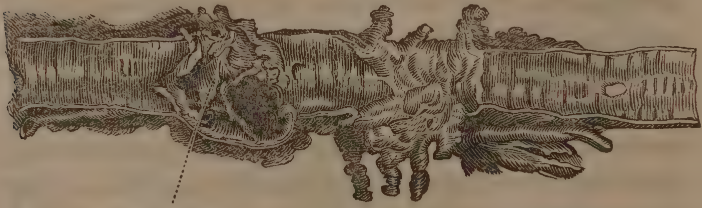
"This dissection fully accounts for the patient's death; but how an artery, not subject to great extension, and thus safely and softly lodged, should be so easily broken, we cannot so readily understand. To resolve this difficulty, I continued my dissection along the artery; I found it perfectly sound for two inches, and then it expanded into a second tumor, of the size of an egg; and, upon opening this aneurism, I found the blood so fairly coagulated in it, as entirely to prevent the passage of the blood through it. This blood being now cleared away, it appeared, that in this aneurism the coats of the artery were eroded in two places; in the one place, all the coats were eroded except the external; in the other, the erosion did not go so deep; betwixt these two places, there stood up, a septum, or partition, which served as a sort of valve. The internal coat of the artery, where it approached the aneurismal parts, and also the internal membrane of the aneurismal sac, was separated into various laminæ, as if it had been touched with some corrugating liquor, which gave me an excellent opportunity of observing the fleshy fibres of the muscular coat, so rarely seen.

"Thus it appears, that the obstruction in the lower aneurismal sac caused the bursting of the upper one; and the occasional ease or difficulty with which the blood passed along the lateral branches to the muscles, may account for the successive burstings.

"These things being noticed, let us consider (says Guattani) the posture of a man straining under a heavy weight, slipping one foot, and striving to support himself upon the other! let us see what would happen. The Tendo Achillis is tense, the Gastrocnemii muscles are in full action, so also is the Triceps through the tendon of which the artery passes; and the tension of the triceps, by straitening its tendon, must compress the artery, hindering the blood from moving freely downwards in it. The aorta and iliac vessels are strongly compressed by the abdominal muscles and femoral ligaments. The blood thus detained in the middle portion of the artery must greatly distend, and force its sides so that they will not easily recover after this pressure is removed, especially when the arterial system is weak, as in this man it was, by a constitution naturally delicate, in consequence of frequent diseases, and the exercise of a trying profession.

" This aneurism (says Guattani) proves, if I argue correctly, that whenever the blood of the main artery is obstructed, it passes along the inosculating branches; and in this case there is reason to believe, that the obstruction had been a cause of bursting too sudden to allow of the gradual enlargement of the inosculating arteries."

The whole theory of this important case rests upon the facts. From this history of the dissection we are referred to the plate, which I have copied below. Instead of that aneurismal dilatation and great septum or partition which we almost expect, we find a drawing of a plain, undilated, lacerated, and rugged artery. The whole drawing represents but six inches of the artery, and the diseased part is so small that there is plainly no room for any remarkable aneurism, especially for two aneurismal sacs.



The artery is of its natural diameter (as the author indeed declares) both above the disease and betwixt the two aneurismal dilatations. There is no large aneurismal sac, nor any thing which should indicate that there had been a great enlargement of the artery*. There is that thickening of the arterial coats which is so frequent in advanced years; there is a separation of the coats, and a slight dilatation, which indicates the predisposition to disease; but there is no aneurism distended to bursting; there is no natural aneurism converted by bursting into false aneurism. The previous dilatation was such only (Guattani himself acknowledges it) as might predispose to laceration; but the actual violence was a laceration of two inches in length, and Guattani plainly attributes that laceration to the pressure of the muscles, and to the sudden strain, which happened a whole year previous to the fatal termination of the disease.

On the authority of Guattani himself, I repeat this as a remarkable example of an artery yielding directly under the strong action of the muscles; and I desire you to observe, First, How well this great artery is supported by its cellular substance, and how slowly it overcomes the resistance of its own sheath; for had this been a natural aneurism, dilating slowly for a year, and bursting then by mere extension, the appearances on dissection would have been very singular. Second, You will remark, how, when the sheath bursts, and the closer cellular substance which immediately surrounds the artery is torn! the blood escaping among the muscles, tears the cellular substance in the interstices of the muscles from time to time with successive lacerations and successive in-

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[* This figure exactly resembles the artery of the Popliteal or Inguinal aneurism when the sac of cellular membrane is dissected away, of which I have several specimens.]

jections of blood. Third, How the limb is supported by the main artery while its sheath continues firm, and while the blood is confined to the natural channel. And here also I must remind you that this case is an additional proof of the limb surviving the total bursting of the artery supported by the inosculating arteries, not only against this loss of its main artery, but also in spite of the oppression of extravasated blood injected among the muscles, and swelling up the whole limb, and oppressing it to such a degree, as entirely to prevent the pulse of the aneurism.

And yet there may be a sort of misgiving in your mind, that this was not a bursting of the artery; that the strain caused some injury, which injury might bring on disease and dilatation of the vessel; while the sense of inward lacerations in the last days of this man's life might be nothing more than the giving way of the vessel thus dilated. But I will remove all such doubts, by demonstrating to you that the artery is actually ruptured by the strain, and that the progress of the disease, the time of its enlargement, or the degree of extravasation, depend altogether on the manner in which the artery is ruptured, or on the exertions of the limb; for it is the occasional exertion that causes those inward hæmorrhages by which the aneurism is from time to time enlarged.

" A man of about thirty-four years of age was taken in the last week of April with a cramp, a little below his ham, which was followed by an immediate swelling of the calf of the leg, attended with excessive pain, and it continued in much the same state for about three months, when the pain began to increase, and the swelling to enlarge. The whole leg was exceedingly tense, but there was not the least pulsation to be discovered in it, nor the least visible discolouration of the integuments. However, from the deepness of its situation, as well as from the sudden enlargement and the violence of the pain, it was presumed to be aneurism, and on that presumption the operation for aneurism was attempted on the fifteenth of October.

"Upon opening the tumor, the coagulated blood appeared to have acquired a fleshy consistence, and adhered very firmly one portion to another. Upon removing it totally, the tibia and fibula were found carious, and the ruptured artery appeared just between the heads of the tibia and fibula, so that it was impracticable to tie it, or at least judged unadvisable, considering the condition of the leg."—"It was amputated above the knee upon the spot, and the patient did well *."

Here this most important fact is proved in all its circumstances. The sudden rupture of the artery, the slow growth of the tumor, the want of pulsation (which is the usual characteristic of aneurism), but above all the inevitable destruction of the bones, and the incurable nature of the disease! the ease with which the artery might have been tied at first, and the necessity of amputating the limb in the end, are important lessons. In this unfortunate case, six months had elapsed from the bursting of the artery to the final consummation of the disease; the ruptured artery appeared during the operation betwixt the heads of the tibia and fibula; and this first report

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* Vide Warner's Cases in Surgery.

must have been corrected by the dissection of this limb after it was cut off, so as to leave no question concerning this principal fact. If a cramp only of the limb could thus decidedly burst the artery, what may we not apprehend from violent strainings of the limbs, blows, and falls?

We thus perceive, that the very slow growth of an aneurism is perfectly compatible with the most desperate wound, or total laceration of a great artery; and I will farther prove to you, that every artery of the human body, great as well as small, forms its aneurism very slowly.

I have already explained, that every aneurism in the arm, when occasioned by an accident in bleeding, proceeds from a direct wound of the lancet; and moreover that the artery is in general almost entirely cut across, and yet the aneurism of the arm grows very slowly. In one case, where the operation was performed by a gentleman, a surgeon in Leith, the artery was so entirely divided, that the two ends hung together merely by a tag. In further evidence of the arterial trunk having been entirely cut across in that case, and the course of the blood through the inosculations established, I remarked, that the moment the ligature upon the artery was drawn, the pulse was felt distinctly in the wrist; it was, indeed, strong before the operation, and seemed to be little changed by tying the artery; yet this aneurism grew slowly; it was operated upon in the fifth week; and even then had not acquired any uncommon size, being hardly bigger than the fist.

It must not be forgotten, that the fascia of the arm, and especially over the bend of the arm, is singularly strong; that the artery lies in close contact with the fascia, is felt distinctly beating under it, and is sometimes so prominent as to appear through the skin, like the artery of the temple; that while the artery is thus superficial, so as to be exposed to laceration by blows, or even by strains, it is so closely pressed by this fascia, and so well supported by its own peculiar sheath, which lies immediately under, that its aneurism grows very slowly.

Mr. Morrell of Paris, the celebrated surgeon, was called to the neighbouring village of Corbeille to visit one Jean Baptiste Porcher, who kept the inn of St. John the Baptist. He found him with a large aneurism in the bend of the arm, ready to burst, and requiring immediate operation. But as Porcher wished to have the operation performed at his own house, Mr. Morrell, on account of his avocations in Paris, sent Saviard, a man of no less reputation, in his stead.

When Mr. Saviard arrived, the friends seemed to be anxious lest the disease should be attributed to the patient having been bled in the arm about seven weeks before by a country surgeon. They wished to have this question decided before the operation, and the judge of the village would have administered an oath to Mr. Saviard. "The oath," says Saviard, "I resolutely declined; for being a sworn surgeon of Paris, the solemn oath I took on that occasion should be relevant to any occasion, and over all the district." "And though I was assured," says Saviard, "of the innocence of the surgeon, from his bleeding having been performed in the cephalic vein, which takes its course high in the arm, far from the direction in which any artery could be wounded; yet I chose to defer my evidence till after the operation, both that I might represent the circumstances more expressly, and that I might hurry myself into no absurd declaration; for though the cephalic vein does usually run in a direction where there is no artery, yet there may be such a lusus naturæ, since the most celebrated and creditable practitioners have acknowledged that they have pricked an artery when they thought to open only the cephalic vein *."

But all this reasoning had in truth no relation to the case. This accusation had arisen from the petulance and envy of a low and ignorant surgeon of the same village. The artery was burst, and that with a very wide laceration. "This aneurism," says Mr. Saviard, "arose suddenly, in the preceding harvest, from his own natural impetuosity; as he was driving a cart loaded with corn, it stuck deep in a slough or rutt; he hooked his right arm under the wheel to lift it out, and strained with such impatience and violence that he hurt his arm, and suddenly cried out, 'My arm is broken.' The aneurismal tumor began immediately to appear in the bend of the arm, and gradually increased till no longer able to bear it, Porcher was ready to submit to any operation his surgeons might advise."

"Having screwed his tourniquet, Saviard struck his great abscess lancet into the heart of the tumor; then running it upwards he slit up the tumor, and

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* Qu. Can this be a fact which these creditable practitioners allege? Did the accident which they mention proceed from a high forking of the humeral artery, one of the branches passing obliquely across the arm?

with probe-pointed scissars he opened it downwards. Having thus opened the tumor in its whole length, he introduced his fingers, took out the coagulated blood, and letting go the tourniquet he saw the opening in the artery, which was an inch in length, with ragged edges ("dont les bords etoient tout dilacerez"). He then screwed the tourniquet again, demonstrated to the assistants that the artery was not pricked with the lancet, but fairly lacerated; and having thus exculpated the unlucky surgeon, he proceeded in his operation and tied the artery."

There is no case of aneurism in which we are more sensibly struck with the slow progress of the disease, than in wounds of the lower extremity; for if any artery should prevail over the resistance of the surrounding parts, it should be the popliteal or femoral artery; yet, when the aneurism arises from a direct wound of that great artery, the disease proceeds as slowly as in those cases where the bursting of the artery is more doubtful, viz. where the disease has arisen from a strain of the limb.

"A valet was wounded by a sabre in the lower part of the thigh close to the ham, the point of the weapon touching the popliteal artery. The outward wound healed, and there ensued a circumscribed aneurismal tumor, about the size of a turkey's egg, beating strongly and visibly; it increased so very slowly, that more than two months seem to have elapsed from the time of the wound before the surgeons could resolve on performing the operation." This is but a slow growth even for a natural aneurism, especially for the aneurism arising from the wound of so large an artery as this, and yet, if I be not deceived, this artery was not merely wounded, it was entirely cut across. The patient being laid flat upon his belly, Mr. Deschamps, assisted by M. M. Chopart, Pelletier, Boyer, and other eminent surgeons of Paris, made his incision upon the tumor, along the course of the artery. He first cut through the skin and cellular substance; the great nerve being then dissected, and hooked aside with the fingers of the left hand, he cut into the aneurismal sac, slit it up its whole length, turned out the clots of blood, and washed and sponged the cavity of the sac; then both the extent of the sac, and the wound in the artery, were distinctly seen. The artery was absolutely cut across, and you might even have introduced your finger into the open mouth of the artery *.

The femoral artery itself hardly forms its aneurism more rapidly than the popliteal artery did in this instance. I saw a young man whose femoral artery was wounded with a penknife. The gentleman who was first called to him, perhaps, was not aware that the blood proceeded from the great artery. The day

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* With so many circumstances of the description coinciding, I have not the smallest doubt that the artery was cut across. Whether the author means, that the wounded artery presented itself during the operation, en bouche beantè, I am not so sure. I transcribe the passage, and leave my reader to judge for himself. For the conclusion that I mean to establish, it is enough that the artery was wounded with the sabre.

"Alors, en écartant le nerf avec les doigts de la main gauche, j'agrandis l'ouverture du sac haut et bas. Ceci fait, j'ôtai tous les caillots; je lavai et epongai exactement tout l'interieur du foyer: Celui-ci parfaitement à sec, j'observai son etendue et le lieu de la blessure de l'artère: elle se presentoit à la vue d'une manière bien sensible; elle etoit entierement coupée, le désordre, dans cette partie, étoit tel, que l'on pouvoit facilement introduire le bout du doigt dans le lieu ou l'artere avoit été coupée."

following, the aneurism began to form, but as yet the wounded artery was not so far removed from the fascia and surface of the thigh but that pure blood found its way out through the integuments, and he lost at a few strokes of the heart no less than three pounds of blood; but on the third day the coagula were so firm, the wounded artery so deeply buried under the coagulating blood, and the external wound so steadily compressed, that it healed. The aneurism then assumed its proper form of a great pulsating tumor; and it was at the distance of three weeks from the time of the wound that the operation was performed upon an aneurismal sac, so small and circumscribed, that the limb in general was but little swelled, and this small, circumscribed, and beating aneurism was entirely limited to the upper and fore part of the thigh.

If you look into that case related by Mr. Burchall surgeon in Manchester * (one of the earliest cases in which the operation for femoral aneurism was performed with success), you will find a true picture of the manner in which a great artery when wounded forms its aneurism; it grows, indeed, as slowly and as gradually almost as if the aneurism were spontaneous, i. e. from a dilatation of the arterial coats. The aneurism operated upon by Mr. Burchall happened from the following accident: Isaac Ashton, a stout healthy young man, about thirty-five years of age, was sitting in a careless way cutting a rag or flaw from the root of his nail, and the scissars, which were very sharp pointed, dropping betwixt his thighs,

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* Vide Medical Observations and Inquiries, vol. iii. p. 106.

he suddenly clapped his knees together to catch them, and struck the points directly into his thigh, and wounded the femoral artery. The blood instantly spurted out from the wounded vessel, but the bleeding was soon stopped, and the external wound healed up in a few days. Then a small tumor formed in the thigh; it was growing larger, and was somewhat painful, when he consulted a gentleman in the country, who tried various remedies in vain. To this gentleman surely the symptoms of aneurism had not appeared very decisive, nor the tumor very formidable; but it grew gradually more painful, and increased slowly in size. The man was now sent to the town of Manchester for advice, where his disease was soon recognised as an aneurism of the femoral artery; and the operation was accordingly performed with the happiest success; but so slowly had the aneurism of this great artery increased, that the man lingered three months in the country after the accident! He was brought into the hospital at Manchester on the 28th of February; it was the 4th of March before the operation was performed, more than three months after the wound.

But where the femoral artery is not merely wounded, but entirely cut or broken across, it will no doubt form its aneurism more rapidly, perhaps in three weeks, instead of three months, as happened in a case which occurred to my friend Mr. Harkness. The patient was master of a small trading vessel belonging to Borrowstounness, a very stout athletic man, about forty years of age. Six months before he had broken his thigh bone, the fracture was healed, but had been set so clumsily, that the lower end of the broken bone projected upwards like a trochanter! The whole weight of the body rested very obliquely upon the thigh, which was manifestly in danger from future accidents; yet while the bones continued united, the leg was strong and serviceable.

One day, in loading some goods into his vessel, he slipped his foot, and fell; though this limb never actually touched the ground, the callus had snapped across, the bones passed one another, and the femoral artery partly by the angle which it made over the prominent end of the broken bone, and partly by the sharpness of the bone itself, was torn almost entirely across. Even this aneurism did not increase very suddenly, and never acquired a very great size; it formed for itself a regular sac; and moreover, when near bursting, lost its round and circumscribed form, and became flat. It is easy to imagine that an artery in these circumstances could not be well supported by its cellular substance; for the bones had been but lately reunited by a callus, they were now broken again, and all the surrounding cellular substance destroyed; there was already, as it were, a cavity prepared for receiving the blood of the artery; accordingly the moment the man's foot slipped under him, he felt extreme pain from the various parts which were lacerated, and even that night the tumor began to form! The next day the tumor was large, and pulsated very strongly, and in a few days its pulsation was so powerful as to raise the bedclothes. But from the time in which the artery began to be resisted by the thick muscles and fascia of the thigh (for the aneurism lay altogether under the belly of the vastus internus), it hardly increased in size; it remained quite stationary for a fortnight or more; even the pulsation, which had begun to be very powerful, was in some degree deadened by the accumulation of blood and the pressure of the surrounding parts, and somewhat reduced by the enlargement of the collateral arteries. The limb preserved its natural heat and circulation; every thing was favourable to the bold attempt of saving a limb at once fractured in its bones, deprived of its main artery, and loaded with a great aneurism. This operation was once agreed to, but a second consultation condemned the limb to be cut off! it was cut off, and the man died.

Thus we perceive, that even the great femoral artery, although entirely torn across, forms its aneurism but slowly. The amputation of the limb, in this case, was performed the fourth week after the fracture of the bone and bursting of the artery, and yet the aneurism had attained but to a moderate size. The dissection of the limb, which I shall presently describe, will show, that the force of the blood condenses the surrounding cellular substance into a firm sac. The whole case, when we come to reason upon it, will be found to present to us an interesting view of the state of an aneurismal limb, and to prove the extreme danger of amputating, and the propriety of risking the operation of aneurism even in the most desperate circumstances*. But, at present, I go on to prove, that even when the aorta itself bursts, it forms its aneurism very slowly, and does not by any means prove immediately fatal.

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* Perhaps there is no case in which the slow progress of the aneurism of a great artery is more remarkable than in that of Stewart the leech-gatherer, related in the First Volume, in the Chapter on Wounded Arteries, who was wounded with the point of a pair of scissars in the hip, and the glutæal artery was cut entirely across. He received this wound in stepping out of a boat in one

An officer of distinction, about forty years of age, was wounded in the battle of Fontenoy, and from his long confinement to bed he fell into bad health. He was distressed during his confinement with nephritic complaints, and soon after his recovery was seized with vomiting and spitting of blood. He went to Bristol Wells, recovered his health, and continued for nearly ten years to live a careful and regular life, attentive to his exercise on horseback, to his diet, and to the quantity of wine he drank.

About ten years after these complaints he seems to have been suddenly seized with very inexplicable distress, which soon ended in his death. He began first to complain of want of rest, tenesmus, gripes, and mucous stools, streaked with blood. These symptoms were appeased by some draughts of oil, manna, and rhubarb, but the watchfulness continued. The patient felt more than usual pain in his belly, especially in the left side; he feared a return of his gravellish complaints, and about a month after this first attack he consulted Sir John Pringle. A hiccup had come on, the pain was now constant, sharp, darting to his back, groins, and testicles, it was especially severe when he turned to his right side, but he never attempted to turn upon his left. These were

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of the most northerly counties in Scotland, Caithness or Ross-shire. His aneurism was in not the smallest danger of bursting when he came under my care, though he had been wounded six weeks before, and had travelled on foot and in carts more than three hundred miles.

the decisive marks of some organic disease. The disorder was quite unaccountable. His pulse was quicker, harder, and fuller than natural. He had some degree of thirst, but his head was clear. Such was the degree of watchfulness, that for six weeks he had not been sensible of slumbering half an hour; for the last three weeks of his life, he was hardly sensible of having even closed his eyes. His feet, he observed, were sometimes benumbed, which made him call for more wine than usual; and though he had no sickness at his stomach, his appetite was gone. He was bled, but as he grew daily weaker they were afraid to repeat the bleeding, and for his hiccup, he took musk and absorbents without effect. Opiates were not omitted; and both on account of the hiccup, and in order to procure sleep, laudanum was given, at first in smaller doses, but his physicians were soon obliged to give it to the amount of one hundred drops during the night, without checking the hiccup, or obtaining sleep, but it raised a general perspiration. He seemed after this to be relieved; his spirits revived, the pain ceased; but this was the deceitful prelude to death. On the day of his death, he continued all the morning wide awake, sensible and in good spirits, but with an incessant hiccup. About four in the afternoon he called for drink, but before the servant could warm it, he suddenly expired.

The dissection of this gentleman's body proves to us, that the aorta itself sometimes gives way; that the aneurism which its laceration forms is hardly more rapid in its growth than that of a smaller artery; that the sac which it forms out of the loose cellular substance is firmly attached to the artery, as if the aneurism had arisen from mere dilatation. The abdominal viscera were sound, but there was a tumor larger than the fist, of an oblong figure, lying close to the spine by the side of the aorta descendens, and in the direction of that vessel. It began as high as the emulgent arteries, descended nearly to the pelvis, and was of a very firm consistence. It was found to consist of coagulated blood condensed in the cellular substance, and under the adjacent parts of the periosteum were some detached parcels of extravasation. This abdominal portion of the aorta along with its tumor were dissected out of the body, together with a part of the thoracic aorta and of the common iliac arteries; and the middle part of the aorta being laid open through its whole length, there was observed in the space between the emulgents and lower mesenteric arteries, a complete rupture of all its coats. The aperture had lacerated edges, was big enough to admit the point of the dissector's thumb, and led into a tumor which now appeared to be a spurious aneurism of the great artery, that is, a sac formed of the cellular membrane, containing blood of different degrees of coagulation, which apparently had issued at different times from the aorta.

The neatness of this dissection prevents all those doubts which puzzle us in cases less correctly related; but the case is written by Sir John Pringle, the dissection was performed by Hunter; the tumor was not first mangled, more canino, and then the connexions and causes of it stated in idle conjectures. The aorta was slit up on that side which was sound. The dissectors saw clearly the connexion of the tumor with the artery. The artery was burst, the laceration had ragged edges, preventing all suspicion of previous dilatation; the breach was such as to admit the dissector's thumb, and was proportioned to the size of the artery. The sac was formed in the cellular substance, condensed in proportion to the driving of the blood, and it adhered so to the artery as to be cut out along with it, and certainly would have been reported by less dexterous dissectors as a natural aneurism which had burst. The blood was collected by several successive extravasations; the artery making (according to the exertions of the body) successive impulses against the cellular substance and against the peritoneum, which serves as the sheath for this vessel. For our entire satisfaction in regard to the nature of this disease, we, in another paragraph, learn also the cause, for "the aorta was not dilated above the aperture, but its coats were at that place harder than natural, as if tending to ossify, and having lost their natural elasticity and toughness, were parted asunder*."

Here, then, is the greatest artery of the body burst! fairly torn asunder, and that without any strain or blow†. The greatest artery of the body, not supported like the femoral artery by a peculiar sheath, nor bedded in firm cellular substance of muscles, but merely covered by the peritoneum, and lodged in the loose cellular substance of the kidney, is yet so supported as to form its aneurism very slowly. The blood is forced into the cellular substance by successive impulses. The sac is fairly circumscribed, and forms an oblong tumor not much bigger than the fist, though of considerable length, lying close to the side of the artery, and so connected with it as to be cut out along with it; well may such a sac be mistaken for that of a natural aneurism in bungling dissections! That every surgeon is able, in bloody operations in the ham or thigh, in aneurisms lying close under the heads of the gastrocnæmii muscles, to distinguish what is the sac of a true, and what of a false aneurism! what arises from the dilatation of the artery, and what from the cellular substance, is not to be believed.

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* "Upon the review of the whole, we conclude that a small aperture had, at first, been made at this weak part of the aorta, some considerable time before the death of the patient; that the tumor had been gradually formed of the oozing of the blood into the cellular membrane surrounding the artery, and which thereupon was dilated into that sac mentioned above." Vid. Sir John Pringle; Medical Essays and Observations of Edinburgh, Vol. III.

† Mr. Else observes, That "the arteries sometimes become ruptured without any previous dilatation. I have (says this author), a preparation of the aorta ascendens, appearing in no place dilated, which exhibits two ruptures; one is small, and situated about half an inch distance from the valves, from which a coagulum was formed

Thus have I proved to you, that an artery is sometimes dilated gradually, sometimes is hurt in its coats, but very often is burst, lacerated, or entirely broken across. That after being burst, it is supported by its sheath. That the cellular substance receives the blood; while the breach in the artery thus walled up

about the size of a large nutmeg, that was seated between the trunk of the aorta and the trunk of the pulmonary artery. From the white appearance of the coagulum, and the regularity of the edges of the rupture, it seemed to be of long standing. The other rupture is much larger, seated at the curvature between the exit of the right and left carotid arteries, the edges of which are torn and irregular, and formed a tumor, which pressing against the lower part of the trachea, and the branches of the bronchia, destroyed the patient by suffocation in less than a month from its first rise, and before there was any appearance of an external swelling."

with coagula, forms its aneurism slowly; that the greatest arteries of the body form their aneurisms slowly, and have the cellular substance and arterial sheath beaten into the form of a distinct sac; and that an aneurism which truly arises from a laceration of the artery may be mistaken for a natural aneurism or simple dilatation of the tube!

CONCLUSION.—CONTAINING A DESCRIPTION OF VARIOUS ANOMALOUS CASES OF ANEURISM.

To what practical uses these speculations may be applied, you will next inquire; for, unless they have some influence on practice, your interest in them should be but very small. You will remark, that no sooner is it proved to you that an artery may be burst by a strain of the limb, than you begin to look upon certain accidents, which are apparently trivial, in a new and serious light. In the case of a direct wound of an artery, succeeded by a large tumor, with strong pulsation, and all the characteristic signs of pure aneurism, you can be at no loss to distinguish the nature of the disease. But too often it happens, that when this disease begins in a sprain, when the pain is great, the pulsation small, and the whole member swelled to a great size, the general swelling conceals the particular swelling of the aneurism, and the limb is destroyed before the surgeon is aware of the nature of the disease. These are the cases which are so generally called anomalous, or, in other words, cases which are not understood. The surgeon is unwilling to believe that an artery is burst by a strain of the limb, just as a hernia is forced down by any sudden exertion: and while the surgeon remains ignorant of the nature of the disease, the artery is actually burst, and is pouring out its blood among the muscles; the bones are corrupted, the joint, too, is presently destroyed, the whole limb is ruined in its texture, swelled, cold, and lifeless. The surgeon cuts it off; and being as little expert in anatomy as judicious in surgery, he, upon finding bones, blood, and matter mixed in one confused mass, learns by his dissection nothing more than he did by his previous inquiries: he calls it an anomalous case! a poor apology this word anomalous, for ignorance, which has cost the patient a limb. But these are not the less aneurisms, because of our being ignorant of their nature and origin, and of that process by which they come to this last stage of irregular suppuration.

This compression of the soft parts, this caries of the bones, and destruction of the joint; this mixture of blood and matter; this confusion of aneurism, caries, and abscess, with a putrid fluid, like coffee-grounds, and a surface nearly gangrenous, is indeed the final termination of every neglected aneurism; but there are certain occasions in which the disease infallibly assumes this form. First, Wherever the aneurism is produced by a broken bone, for there the artery is wounded or broken on the side next the bone, the blood is poured out under the bellies of all the muscles, the resistance to its outward extension is great, and the inward destruction of parts is proportionably rapid. Secondly, When the aneurism happens in the ham, or under the bellies of the gastrocnemii muscles, for there the aneurism is peculiarly straitened, it is pent up betwixt the ham-string tendons, it forms slowly, is singularly hard, and frequently has neither the pulsation nor other marks of aneurism; but the knee joint being destroyed, the bones corrupted, and the limb enormously swelled, is fit for amputation long before the tumor threatens to burst! even amputation is not safe! Thirdly, But most of all, the limb is in danger when the case is not understood; when the artery is not wounded, nor gradually dilated, but actually burst; for the surgeon, little accustomed to think of this bursting of an artery, never apprehends the true nature of the complaint, nor even knows it for aneurism! After having amputated the limb, his exculpation consists in calling it an anomalous case, intimating that it was unintelligible and incurable *.

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* The following case is taken from the Volume on Tumors. The patient was not under my brother's care. He thought that the operation of tying the carotid should have been performed. He did the operation with success, a short time after this was published, and he has given an instance from Petit in support of the propriety of doing so. After reading his Discourse on Inosculations, we cannot for a moment believe that he had any dread of the circulation being impeded by tying the carotid.

The case is valuable, as showing that the aneurismal tumor of the carotid may destroy the patient by irritating the larynx; and while it affords an argument for performing the operation early, it may lead us to consider whether the change likely to take place in the tumor, by tying the artery after it is of a certain size, may not be such as to increase the irritation, and hasten the patient's death. Patients have sunk under the cough which came on after the artery was tied.

" Elizabeth Wallace, a flesh cadie, (a woman serving as porter in the butcher market), no more than twenty-four years of age, had led a very dissolute and abandoned life: about ten days before she took to bed in the Infirmary, she had a cold, or the symptoms of cold; but whether the exertions of coughing had started the carotid artery, or whether the posture in which these people carry their

ANEURISM OF THE CAROTID ARTERY.

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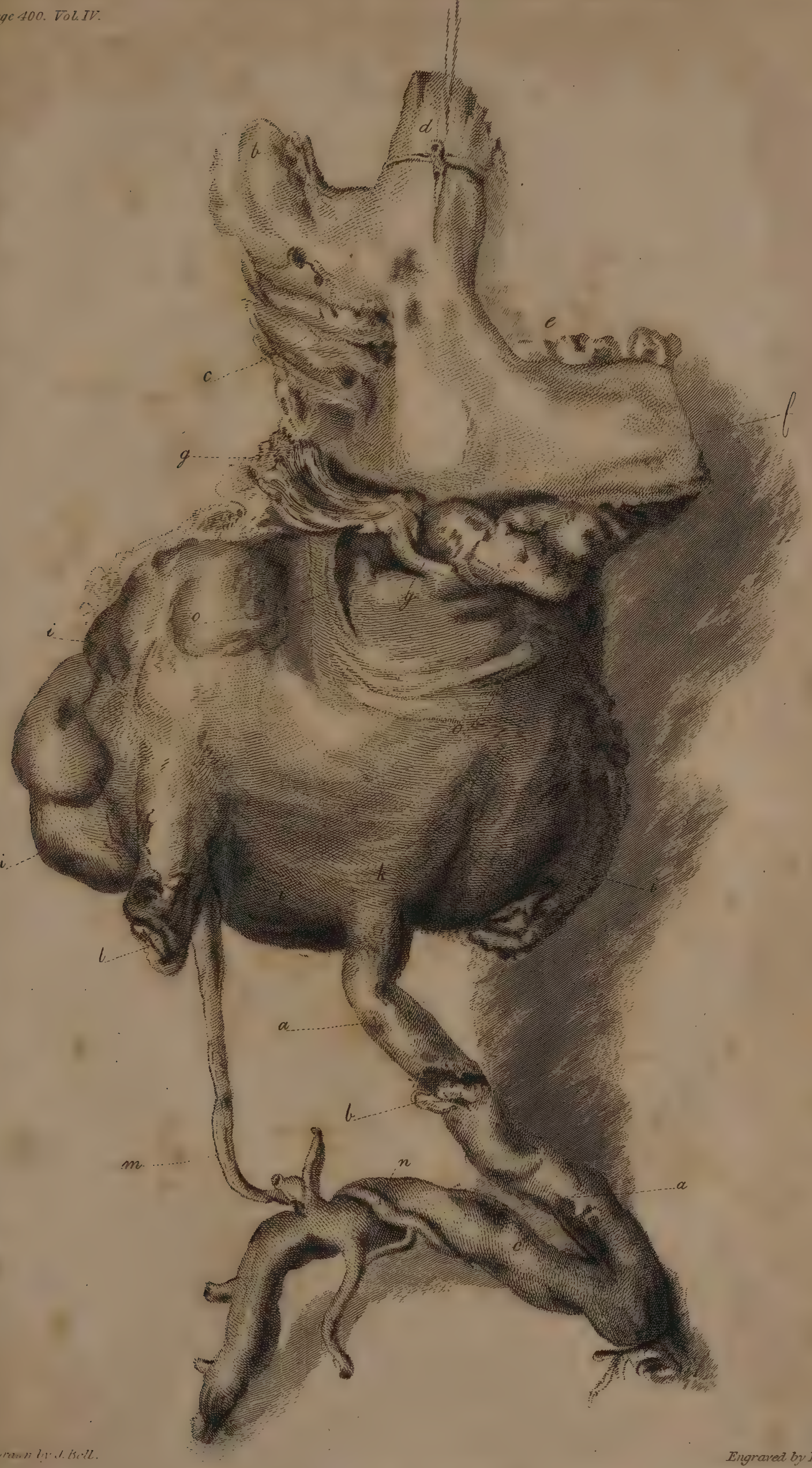

Drawn by J. Bell.

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OF ANEURISM FROM FRACTURE OF THE BONES.

Aneurism, from fracture of the bones, is more or less important according to the artery that is wounded, and the other circumstances of the case. In a fracture near the ancle, the artery is small, the aneurism

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heaviest burdens, strapping their baskets over their forehead, and straining with the neck, had injured the artery, the dilatation of which, and its pressure, had excited the cough, we now can never decide. It was about that period she first observed the lump, which, when she sought an asylum in the Hospital, was yet no bigger than a walnut. She had no other complaint besides cough and difficulty of breathing, but the cough was at times so violent, and accompanied with such straining, that the nurse who watched her, pitied her. At this period, the difficulty of deglutition was slighter, insomuch that she could swallow both meat and drink, yet slowly and painfully.

"About ten days after her admission into the Hospital, the swelling, which had increased from day to day, was prominent and visible; she swallowed with the utmost difficulty; the tumor was perseveringly mistaken by the physicians for the swelling of a sore throat, was embrocated by day with stimulating oils, and by night was covered with a poultice.

"The tumor, by the twenty-fifth day of her disorder, had attained the size of the fist; the difficulty of deglutition, which had increased with the increase of the tumor, was such that she was no longer able to swallow solids; she could force over only a little bread, honey, or gruel: by the thirtieth day, even that was no longer practicable; and she tried, not always successfully, to suck up, through the stalk of a tobacco-pipe, a little thin gruel, or warm milk.

"During the last week of her existence, even this poor resource failed her; whatever she attempted to swallow gushed instantly upwards through the nostrils, with most imminent danger of suffocation: the six days preceding her death, she refrained from all such unavailing attempts, and was sustained, in some degree, by injections of broth and jellies; she pined away, and, after lying some time in a lethargic state, expired without any kind of suffering. Never have I seen a tumor whose character was so strongly pronounced; perhaps this aneurism (like that which is but slightly mentioned, I know not where, of a German nobleman, who, in the exercise of hunting, turned his head suddenly and violently to one superficial, the resistance outwardly is slight, whence the bones within are proportionably less endangered. In such aneurism behind the ancle, in the Fibular Artery, for example, the tumor should be opened, the artery tied, and then the bones reunite, but till you have tied up the artery, you have in general no reunion of the bones. We find that this aneurism also grows very slowly, insomuch that sometimes it

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side, and had thence a fatal aneurism of the carotid artery,) was caused, and the carotid in this woman injured in its coats, by some violent strain in carrying her basket: the smallness of the tumor, its place directly under and behind the angle of the jaw, its manifest connexion with the carotid artery, its rising with each pulsation of the carotid, and getting a stronger pulsation in proportion as its size increased, proved, to my entire satisfaction, that it was a true aneurism, in which the sac filled by the carotid trunk gave a heavier pulsation in proportion as it was dilated. I never saw this poor creature in any violent paroxysm of coughing; I found her always lying with her head low, still, and flat, apparently oppressed, languid, and unwilling to speak, seemingly in a state of stupor, perhaps only languishing for want of food. The tumor occupied the side of the neck, filled all the angle of the jaw, the whole hand spread out upon it just contained it; the pulsation was deep, heavy, and impressive, you could not but feel an awful presentiment that it must soon burst. She lived no longer than six weeks from the very first of her complaints; we saw the aneurism in its incipient stage, and watched it through this short period in which it increased to this fatal size. To know that such a disease does exist, (for this has been doubted,) is enough to put us on our guard, and we cannot wonder, that the pressure of a distended artery, which in the ham destroys the knee-joint, and makes the bones carious, should thus compress the flexible tube of the pharynx, and prevent swallowing. This girl, Wallace, except the cough, had no other complaint, and slept away as one starved to death.

"Nothing could more tempt us to a daring experiment, than the desperate condition of such a patient, nor is there any thing in the relative situation of these parts to deter us: had this woman been under my care, or should ever such a case recur, I should never hesitate one moment, conscious that the most absolute bungler in surgery might lay aside the muscle with a few strokes of his scalpel, open the common sheath of the carotid and its accompanying nerve, and separate the vein, nerve, and artery, so as to tie the latter without let or hindrance."

hardly appears till after the callus is formed, and the patient begins to walk. There are indeed exceptions to the general rule, for the fracture sometimes heals while the aneurism goes on. "A surgeon of Guand, being called to set a broken leg, applied the usual bandages, and in the usual time accomplished the cure. But when the young man began to walk abroad, a tumor was observed behind the ancle, over the place where the bones had been broken: the surgeon (now called again) being ignorant of the nature of the disease, applied a caustic, but when he opened the eschar, instead of matter which he expected, blood gushed out so impetuously, that it was stopped with great difficulty. The young man fainted in the moment of this hæmorrhagy, and expired in two days after*."

When the artery is of another order, larger and lying deep among the muscular flesh close upon the bone by which it has been lacerated, the case is more unfortunate, and if neglected, too frequently terminates in mortification and death. The tumor caused by such an artery is large and diffused, the coagula of blood which oppress the limb are very large, and consequently the pulsation is not distinct and smart, but heavy and throbbing. Knowing, as you do, the principles of surgery, you need not be informed, that before the pulsation can destroy the muscles or make its way through the skin, the bones must be irrecoverably carious, and the soft parts round them destroyed by extravasated blood. That if the oppression be allowed to increase, the limb will fall into gangrene, or the skin burst and the patient bleed to death. And you must be sensible, that if the skin be left to burst from this gangrene, you must then search for the artery and tie it, with but a poor chance of success, the extravasation having quite ruined the texture of the limb. If again the oppression be allowed to increase till the limb become generally swelled, cold, lifeless, and in danger of gangrene, you must cut it off, without perhaps the consolation of saving even the patient's life, for such a limb is apt to run into gangrene.

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* Palfin, Page 341. This is a rare exception to the general rule, that such complicated fracture cannot heal till after the artery is tied. In this case, probably, the artery had formed a small sac for itself, distinct from the lacerated cavity formed by the fractured bones.

When an artery, then, is thus lacerated, along with fracture of the bones, you have but this alternative to cut the limb off at once, if it be very desperately wounded, or to try to save it by making incisions, and tying the artery! If you call a consultation, it is not to decide so clear a point, but to satisfy the friends and exonerate yourself. The fracture is already complicated with aneurism, and you are under the dangerous necessity of converting this complicated aneurism into a compound fracture! You apply your tourniquet, make a long and deep incision, turn out the coagula of blood with your fingers, cleanse the sac with sponges, search for the artery, and tie it up above and below where it is torn. You wash out the blood from the sac with syringes and sponges, for while it lies betwixt the bones they cannot unite; what blood you are forced to leave melts down into bad matter and flows off; the deeper parts of the wound gradually digest, granulate, and fill up with soft flesh; and when the continuity of the parts is thus restored, the new bone or callus begins to form. Such is the activity of a wounded artery in forming its aneurism and destroying the surrounding parts, and so complicated is the disorder when a wounded artery is added to a fractured bone, that unless these operations are performed early, the limb is inevitably lost*.

But when the main artery of the limb is wounded, the aneurism often forms very slowly, and the blood being effused under the great muscles of the limb, the pulsation is very indistinct. In one place firm coagula, together with the injection of the cellular substance, makes the tumor hard and firm, and there the pulsation is not felt; but in another part, the walls of the tumor, in the interstices of the extended muscles, are thin, and there pulsation is perceived. The whole integuments of the limb inflame and thicken with effusion into the cellular substance, so that the nature of the disease is very uncertain, the case is misunderstood, the parts are left to suffer all those changes which the accidents of the case may induce.

During the progress of this effusion, the inosculating arteries are enlarged, ensuring the safety of the limb, and adding force to the other proofs of aneurism being seldom fatal from absolute gangrene; while the bone itself undergoes changes much more remarkable than those of the soft parts. Of these changes, I know none more singular than that kind of exostosis which exudes as it were from the bone, forming sometimes a large and regular cavity, or branching out into the most irregular shapes. When a bone is broken and the great artery wounded, the blood is extravasated betwixt the ends of the bone. The aneurism is formed within the lacerated periosteum, the fracture becomes a part of the aneurismal sac, the internal parts of the system of the bone cannot reunite, and granules and splinters of bone are accordingly found, at a great distance of time, floating loose, as if half dissolved in the aneurismal blood, while the ends of the broken bones remain rough.

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* The danger of gangrene in such a case, is from the injury to the limb and consequent swelling, which hinders the action of the collateral branches, which have now to perform the office of the main artery.

But the condition of the periosteum must chiefly be regarded; for being part of the system of the broken bone, it is capable of generating new bone, and the form of that bone will be regulated by the parts upon which it may be moulded. The periosteum being now expanded into the form of a cyst over the broken bone and aneurismal blood, its new secretion of bone will spread over the aneurism. The outside of the periosteum is still connected with the muscles and other soft parts, it is nourished and receives its vessels from without, and lives, and thickens, and begins a secretion of bone. The secretion while it is in this unnatural extended condition is very powerful, and the bone which is formed by this dilated or expanded periosteum, is not only firm, but broad like a skull. We often see the lacerated periosteum and the membranes of fractured and luxated joints, or of carious bones, forming great bony caries or stalactitic-like projections. In gunshot wounds, with fractures of the upper part of the thigh bone, in the scrofulous caries of the hip joint, in luxations of the thigh bone from the acetabulum, in fractures of the cervix femoris, in compound fractures and luxations of the wrist, and in fractures of the shoulder bone, bony cavities are often formed as big as the head of a new born child. In cases of aneurism, it is more difficult for the periosteum to live, or to form those bony cavities; but when such cavities are formed, they are filled with blood like coffee-grounds, and constitute a most irregular, or as it has been termed, anomalous disease; and round the outside of such bony cavities go the enlarged branches of the artery, which preserve the limb notwithstanding all this disorder. It is in such cases that we are almost at a loss to say, whether aneurism or exostosis has most share in forming this fatal tumor.

I shall illustrate this species of mixed aneurism, by relating a case which was communicated to me two years ago by my friend Dr. Jeffrey, professor of anatomy in Glasgow, whose abilities and zeal are universally known *. Dr. Jeffrey had the goodness to send me along with the preparation, from which I have made these drawings, the following short narrative of the case:

"An old woman of about fifty years of age was rode down in the streets by a cart, and her arm broken in two places. One of those fractures was about two inches above the elbow, the other was above the middle of the arm, and the whole bone

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* It is not natural to mention a friend of Dr. Jeffrey's rank in our profession, without some marked testimony of respect and attachment. Yet I will not presume to express in this note the sentiments I feel towards Dr. Jeffrey, whose name should rather have appeared in the most distinguished and respectful place in my book.

was greatly shattered; yet this poor creature had no assistance, no surgeon was called, the arm remained unattended to for six weeks, when Mr. Parlane, a surgeon in Glasgow, visited her and found the arm greatly swelled, so that he could neither distinctly understand the nature of the injury nor the condition of the bone; it was presumed that there was a fracture, and the patient was laid in a posture favourable to the reunion of the bone.

"The tumor never subsided but increased, occupied the whole arm from the elbow to the top of the shoulder; pulsation was distinctly felt at the top of the shoulder, but of such a kind as might proceed from some artery near the surface. It was judged to be really so; the idea of an aneurism certainly had never struck the gentleman who attended her, for he opened the tumor, which was soft and fluctuating; there was no doubt of its containing a fluid of some kind or other; the lancet was struck into it, but instead of matter, as was expected, blood flowed in a full stream.

"This puncture healed up easily, the tumor which had subsided when it was thus imprudently opened, soon filled up again to its full size, and the hand and fore arm became œdematous and cold. In this condition the patient survived five months, the tumor pulsating manifestly, especially in its upper part; but how this woman died, or after what kind of sufferings, is not related in the case.

"On opening the body after death, eight months and more having elapsed from the time of the fracture, a profusion of mixed and putrid blood like coffee-grounds was discharged. Two inches of the lower part of the bone retained its natural form, all the middle part of the bone was destroyed, the head only remained on the upper part of the tumor, but with its cancelli quite eroded, nothing being left but the mere shell. Through the whole length of the bone, the cancelli were completely dissolved, and the outer bony lamina were found adhering to the whole inner surface of the sac; many pieces of the bone were found in the heart of the tumor, and on the fore part and middle of the tumor was found one piece of bone two inches and a half long and nearly two broad.

"Although the humeral artery was injected, it could not be perceived from what branch of it the tumor was produced."

We need but to review in the history of this case, a few circumstances in order to understand the whole disease in the most unequivocal manner. First, The sudden rising of the tumor, the swelling of the whole arm, the fluctuation, the pulsation in the upper part of the tumor, prove, that though the chief part of the tumor is found upon dissection to be bony, yet aneurism, and not exostosis, formed the basis of the disease. Secondly, The striking of the lancet into the tumor shows that there was blood very early; the sudden filling up of the tumor to its full size, after having been punctured with the lancet, shows that the artery was open at that time, and throwing its blood freely into the sac; and finally, the bony cavity being filled at the time of death with nothing but corrupted blood, which always after long delay assumes the appearance of coffee-grounds, proves the tumor to be merely an aneurism, but it is a complicated aneurism, it is combined with a fractured bone; and the condition of the periosteum accounts for the generation of such extensive plates of bone, equal to a cranium in size, and something like it in the breadth and flatness of the ossifications. Thirdly, It being proved that the disease was aneurism, it is next to be observed, that there is not belonging to the humeral artery, as to the femoral, a great profunda, or collateral branch, as large as the trunk itself; there are but two muscular branches in the arm, and those not larger than crow quills; there is no artery except the trunk itself equal to the production of such an aneurism. The branches which run on the inner surface of this tumor are all singularly well injected, which shows that none of these had any share in producing the aneurism, and surely none of them had terminated in the bag; even the force of the injection had not burst their most delicate branches; they were full of the injection, and the bag empty. While the entireness of these branches proves that they had no share in forming the aneurism, the enlargement of the profunda inferior, to such a size as to rival the trunk itself in diameter, is another proof that the trunk was wounded below the point where it is tied, for nothing but the wound of the trunk could thus enlarge the profunda.

This is one of those cases in which, as I have expressed myself, one is almost at a loss to decide, whether aneurism or exostosis has the greater share in forming the disease. The confusion of the case is almost an apology for any mistake of the surgeon; yet the suddenness of the tumor, the pulsation, the blood following the lancet, were signs too conclusive to allow of any doubt. There must have been in a certain stage of this case such œdema, oppression, coldness of the limb, and suppression of the pulse, as might have intimated to the surgeon that the change in the state of the circulation had taken place, on which the fate of such a limb depends. The patient living with an aneurism certainly proceeding from the rupture of the great artery; living also under such a complicated and oppressive disorder, fracture, exostosis, and extravasated blood, proves to us that there is hardly any case in which we need despair; and the enlargement of all the arteries in this limb, is authority for performing the operation for aneurism, even when the main artery is ruptured, along with a fracture of the bone.

A limb, from this combination of fracture and aneurism, often falls into such disorder that it is cut off, the surgeon himself not knowing why. I have a preparation taken from a man whose leg was cut off in a public Infirmary in this country, but his case was very imperfectly recorded: "The disease was a compound fracture; the tibia and fibula were fractured obliquely near the heads of the bones, and were much splintered; the limb swelled immensely after the accident; but though the limb was set, and the bones replaced, the swelling did not as usual subside, but, on the contrary, it was discovered a few days after, that the tumor was of a fluid nature. It was punctured with the lancet, but nothing issued except grumous blood, and the probe went down into a large cavity filled with coagula. It was now resolved to open the tumor very freely, and many large coagula of blood were taken out. The tumor being thus cleared of its contents, a large deep-seated artery sprung, and the leg was immediately cut off."

This is the usual short process: the surgeons had gone too far in digging into the centre of a disease which they did not understand; when they took out the coagula, they might have expected florid blood! but their hurry and alarm prevented any consultation on the case, and they cut off the limb. Yet, however rash we may think this operation, it was at all events better to look into the disease thus early, and cut off the limb, than leave the aneurism to make the bones carious, and destroy the joint. We perceive, that the fibula is broken near its head, and has a large splinter, which has torn the artery. We perceive, that this hole in the artery is just at the forking of the main artery into the tibial and fibular arteries; we are sensible, that such a wound is equal to a total rupture of the main artery; and since this man's limb continued thus to survive the loss of its arterial trunk, since we also find the articular artery, and the curling muscular branch of the gastrocnæmii, considerably enlarged, we have every reason to believe, that had the artery, when it thus threw out its blood, been simply tied, the issue of the operation would have been fortunate.

This brings us naturally to the second cause of this anomalous form of the aneurism, viz. its being confined within the narrow cavity of the ham.

PECULIARITIES OF POPLITEAL ANEURISM.

In all cases of neglected aneurism, this destruction of the soft parts, and caries of the bones, is the last stage of the disease. But in popliteal aneurism, whether proceeding from slow dilatation, or arising from a sudden bursting from strains, fractures, or wounds, the danger is peculiar; for the aneurism is so confined under the bellies of the gastrocnæmii muscles, and betwixt the tendons of the ham-strings, that the resistance to its extension is very great, the destruction within is proportionably rapid, and the disease is always attended with severe pain.

The popliteal artery bends over the condyles of the thigh bone, passes behind the knee joint, and is affected by every motion of the joint. It also lies under the gastrocnæmii muscles, whence it is endangered by every strain of a limb which is very powerful, and which continually supports the whole weight of the body. The disease, when it happens in the ham, corresponds but too well with the theory we have laid down; it is produced merely by a strain, and ends often in total destruction of all the adjacent parts. A man, for example, has a fall from his horse and hurts his ham, or strains it in mounting his horse; or his limb falls in betwixt the rounds of a ladder, and is violently and suddenly bent; or he receives a blow upon the ham, or he takes a sudden cramp in the calf of his leg, and from that moment his pains and lameness begin. Whether the artery be merely stretched, racked and inflamed, or whether it absolutely give way and bursts under such accidents, is little to the present purpose, but thus it is that the disease begins, and is long unsuspected by the surgeon, while the patient walks, or refrains from walking, by fits, as the pain happens to be more or less violent, rubbing the part perhaps with camphorated oil.

Thus all parties continue indifferent to one of the most fatal diseases. The ham is straitened, whence the tumor, even from the first, is of a stony hardness. From this straitness it loses very early the marks of aneurism, for the pulsation often ceases, or is very obscure. The tumor (even in natural aneurism of the ham) is not always clearly circumscribed, nor to be fairly traced to any connexion with the artery; and being covered, and its pulse suppressed by the great thickness of the muscles and skin, the nature of the disease remains unknown. From the same pressure the leg becomes very early cold and œdematous; for the veins, lymphatics and artery, all pass in this straitened cavity of the ham, the pressure upon these produces a general swelling of the limb, and the general swelling conceals the particular tumor. From the elevation of the bellies of the gastrocnæmii muscles over the tumor, and from the distension of the ham-string muscles, the limb is thrown into severe and painful cramps; and from the nerve passing over the tumor (pressed sometimes quite flat), a very distressing numbness is always felt, and the lameness and pain are such as the external swelling cannot account for. All these distresses of pain, cramps, swelling, and general numbness of the limb increasing every day, the patient sometimes dies of locked jaw, fever, or long suffering and want of rest, the disease becoming fatal before that period arrives in which the tumor bursts.

Every step in the progress of this disease, even that enlargement of the inosculating arteries which is so much wished for by the surgeon, removes the disease farther from the possibility of a cure. When at last we do operate, we find in boring through the coagulated blood, that our finger enters among carious bones, or passes into the cavity of the knee joint; we are sensible that to persist in the operation were vain and cruel; the leg is too far gone, and must be cut off, and when we amputate, we are conscious that, in a limb so swelled and disordered, there is the utmost danger of gangrene.

While it is the lacerated artery which produces all this confusion and disorder of the joint with caries of the bones, the operation itself is certainly successful when done before the extravasation has hurt the texture of the parts; and we have next to contrast, with the happy issue of this early operation, those cases in which the limb is cut off, after a few months delay. In a case formerly related, the disease proceeded not from a blow, a fall, or any external injury; the man was taken with a cramp in his leg; there was no pulsation, nor any other sign nor characteristic of aneurism; but when, after six months, they ventured to perform the operation, they saw distinctly the mouth, "the orifice of the ruptured artery," but it was too late to tie it, the bones were carious, and they were forced to cut off the leg *;

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* In the month of December, 1756, J. Y. aged thirty-five, received a hurt upon and about his knee, by falling to the ground from a man's back; the accident was immediately followed by a considerable degree of lameness and pain, which were increased by walking or standing; he continued in much the same state for about six weeks after the accident, at the end of this time the calf of the leg was attacked with an œdematous swelling, and in a fortnight afterwards it became so painful as to disable him from walking. The tumor continued to grow for about eight weeks, and at length extended itself so far upwards, as to affect the greatest part of the thigh, the whole of which was attended with excessive pain, but more particularly so about the knee. Thus much is related from the patient's own account.

and in the case which I have printed on the margin below, you will find the same tragedy recited again, with but a small variety in the circumstances. Go, indeed to what collection of cases you will, you find

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On the 28th of April, 1757, he was admitted into Guy's Hospital under my care. Upon examination, the thigh appeared enlarged to a very great size. The tumor was uniform, and extended from the inside of the knee to within a small space of the groin ; the integuments were in every part of their natural colour. Upon pressing the inside of the thigh it appeared soft, where a fluctuation was discoverable, but there was not the least appearance of pulsation on this or any other part of the limb. The tumor on its superior, posterior, and lateral parts, was of a stony hardness.

The leg (which according to the patient's account) had some time since been much swelled, did not now appear to be at all so. He was continually in great pain, and for some time past had been incapable of taking his usual rest : his appetite was bad, he was a good deal emaciated, he had a constant slow fever, which began about five weeks before his admission into the hospital ; he appeared pale and sallow in his complexion. From the time of his being placed under my care to the end of ten days, there was no apparent alteration in the swelling, nor in the symptoms attending it. In expectation therefore of affording him that relief which I thought could by no other means be given, I judged it advisable to open the tumor, which I did by making an incision into its most prominent part, upon which there immediately gushed out a large stream of thin florid blood, and at this instant discovered to me the true state of that disease, which till now could not be ascertained by any peculiar symptom distinguishable by the touch, or perceptible to the eye ; seeing this, I immediately filled up the wound with lint and tow, and proceeded in as expeditious a manner as possible to apply a tight bandage upon the thigh near to the groin ; and lest this might accidentally break, I applied a second ligature a little below the first, and proceeded to amputate the limb upon the spot. During the operation the patient fainted, but he soon came to himself again, and without any bad symptom gradually recovered his health, strength, appetite, and rest, and is now in good health.

Upon a dissection of the thigh and leg, I discovered the following appearances : A considerable part of the fleshy portions of two of the extensor muscles of the leg, to wit, the Vastus Internus and Crureus, with the subjacent Periosteum, were destroyed. Four of those muscles whose uses are to bend the leg, and which compose the internal and external hamstrings, to wit, the Gracilis, Semitendinosus, Semimembranosus, and Biceps Tibiæ, together with that adductor and flexor muscle of the leg called Sartorius, were removed in almost every volume, under the title of an anomalous case, a story of a neglected aneurism and amputated limb, and in every case you will see how little the surgeon had attended to the history of the disease, how little he expected blood, or a lacerated artery; you will observe what horror this unexpected hæmorrhagy excites, and with what precipitation and hurry the limb is cut off*.

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at a considerable distance from the inferior part of the thigh bone, and from the upper parts of the tibia and fibula; by which means a large bed was formed for containing the extravasation; which consisted in part of a fluid, and in part of a coagulated blood; by much the greatest portion of the coagulated blood was firm, and had acquired the texture and appearance of brown macerated leather. The several muscles I have mentioned had a livid and putrid appearance. The Os Femoris was carious on its anterior and posterior parts, and for the space of several inches above the condyles of that bone with the course of the linea aspera, as well as on the convex or anterior part of it, there were many exostoses.

The capsular ligament of the knee joint was much thickened, and contained about two ounces of a yellow and viscid synovia.

* "The history of a case affording a proof of the power of extravasated blood in dissolving bone."—Vide Dr. Duncan's Commentary, Vol. VI.

"A man of a strong and healthy habit, aged about forty-five, upon lifting a heavy weight on the first of October, 1777, thought he felt something give way in his right hip. Immediately after he was very faint, but soon recovered, and for six or seven days followed his usual occupation, which was that of a brewer's servant, with little inconvenience. During that time, he perceived an unusual weakness in the leg and thigh, but attended with little or no pain, and it was treated as a sprain, with spirituous and oily embrocations. At the end of three weeks his thigh was considerably swelled, and in ten weeks time from the accident (when I first saw him) it was very much enlarged, and the leg and foot œdematous. He had frequent returns of excruciating pain in that thigh, but it was sometimes perfectly easy, and the other leg and thigh would be inflamed and painful; sometimes he was delirious, at others had violent pain in his stomach, attended with great sickness and vomiting, which could only be relieved by volatile and cordial medicines.

"As I was uninformed of the preceding accident, and could discover no pulsation or fluctuation in the tumor, the patient's history, together with the above symptoms favouring the supposition, I

Although it is very certain that aneurism is often unattended with pulsation, yet it is not unlikely that sometimes those collections of blood which fill the ham, and hurt the joint, and end in caries of the

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at first believed the disease to be entirely rheumatic. The thigh continued growing larger, till the first of January, 1788, when it became very tense, in continual pain, and I could perceive a deep seated fluctuation. As he had no hectic fever or other symptoms that could induce me to suppose this fluid was pus, I began to suspect a false aneurism. The tension and pain being excessive, I recommended emollient fomentations and cataplasms, which, for a night, gave great relief, excepting when these pains, which by turns invaded every part of his body, were fixed in the diseased thigh. On the twelfth of February, the thigh was amazingly distended, in constant and excessive pains, which nothing could alleviate, and a fluctuation was felt in every part of it, from the groin to the knee. At this time it was examined by a surgeon of skill and reputation, who, considering the exquisite sufferings of the patient, and being uncertain what was the fluid contained in his thigh, thought proper to open it; and accordingly a small puncture was made through the skin, cellular membrane, and fascia lata. Immediately there issued a fountain of blood, of the consistence of cream, and a darker colour than blood is in general when fresh and drawn from a vein. When about a quarter of blood was drawn off, the thigh was considerably diminished, and the patient easy. We stopped the orifice with a tent, and left the patient till morning.

"Feb. 13. He had fainted several times in the night, and this morning the thigh was almost as much distended as before the incision was made; at the same time, the blood was constantly oozing through the orifice.

"Feb. 14. His thigh was in the same state as yesterday. He had a return of the pain in his stomach, which yielded to no medicine; in the evening he became delirious, had convulsions, and died.

"What induced me to lay this case before you was the appearance upon dissection. That blood has the power of dissolving bone, if it comes in contact with it in the living body, though a certain fact, yet it is not universally believed. This case not only proves the truth of that idea, but it also shows, that extravasated blood, when long confined, has likewise the power of dissolving the softer parts.

"Having cut through the integuments and tendinous fascia of the thigh, I could pass my hand quite round the bone, the muscles, except their tendinous portions, being dissolved to the consistence of grumous blood, which, with a great quantity of pure blood, was contained, as it were, in a bag, formed by the integuments of the bones, proceed from ruptures of the veins; for the veins, more delicate than the arteries, are exposed to the same violences as the artery, since they accompany it; and varices of the internal veins are capable of producing similar effects with proper aneurisms.

fascia lata from the groin and crista of the ilium to the joint of the knee. The crural artery, vein, and nerve, were entirely dissolved (and yet the limb had survived—observe how often this fact is obtruded upon us), and the iliac artery a little way was very tender. The os femoris was deprived of its periosteum, very rough and full of holes, some of which would admit a probe into the middle of the bone, which seemed destitute of medulla. At the same time there were several exostoses upon it, which were so slender as to be easily broke down by the finger. As I was not permitted to take away the bone, or to open the abdomen, I cannot give a more satisfactory account of the case; but I imagine it sufficiently proves the solvent power of the blood as exerted both on the softest and hardest parts of the system."

Perhaps there cannot be pointed out to your observation a more interesting case than this. How limbs may be cut off, or even life itself lost, from not understanding the nature of such a disease, is but too manifest; there was not one circumstance of the case understood, and I hope there is not one which you can be at a loss to explain. The corrupting of the bone, and the destruction of its periosteum, are no more connected in the report than if bone and periosteum were not alive, and had no more connexion naturally with each other than the glove with the hand! The blood is considered merely as a menstruum, capable of dissolving bone, as an acid would dissolve a calcareous stone! Nothing is attributed to the actions of the living body. An aneurism is suffered for four months to undermine the cellular substance, to choke, insulate, and destroy the muscles, to spoil the periosteum, and by that to destroy the bone. This aneurism is tapped with a lancet, as if it were an abscess; the man faints from the inward bleeding of the artery, the sac fills up before morning to its former size, the blood oozes through this imprudent opening, and the man dies. Instead of lamenting his fate, or of understanding the case, even after dissection, it is related as an instance! of what? Why, of blood dissolving bone. But I think it is an instance of something much more important, and am persuaded that nothing would be more useful to the public than a set of critical and monitory observations addressed to young surgeons, and attached to the many valuable cases which are published in various collections. If God spare me health and spirits for such a task, I will perform it.

The destruction of the bones arises not from the pulsation of aneurism, nor from any thing peculiar in the nature of the arterial blood, but merely from the injection of the cellular substance with the blood, together with the general pressure, and the internal ulceration, from the presence of a foreign body. Perhaps the sudden rising of a tumor from a strain of the limb, a sense of laceration in the part, the slow increase of the tumor, and the total absence of pulsation through all its stages, may be esteemed among the signs of a ruptured vein *.

CONCLUSION.

I believe that little now remains to be done, except to draw the natural conclusions from this history of the disease.

First, We now perceive why the operation for popliteal aneurism has been so singularly unsuccessful. The straitness of the ham, the destruction of the soft parts, the pressure upon the muscles till they are hardly more alive than the coagulated blood which oppresses them, even that enlargement of the inosculating arteries which surgeons have always wished for, are unfavourable to our success; delay

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* In one case the disorder was fairly traced to the veins. Mr. Else in his works relates a case of this kind, in which the limb was amputated on account of the caries of the bone. Upon throwing a wax injection into the arteries, it was not extravasated in the tumor, but ran freely along the arteries to the foot. Upon examining the great vein, a rupture was found immediately above one of the valves.

But the other cases, which Mr. Else believed to have been ruptures of the veins, were quite another disease.

is fatal! when the bones have become carious, success is impossible.

Second, The surgeon neglects the operation because he is uncertain of the nature of the disease. The disease proceeds not from any wound or blow, but, on the contrary, the swelling and weakness are first observed immediately after a strain of the limb. The surgeon is unwilling to believe that any such accidents can give rise to a true aneurism! That pulsation also, which he judges to be the only sure sign of aneurism, is often wanting, especially in the latter stages of the disease.

Third, It has been too much a fashion among surgeons to say, at the end of any unsatisfactory consultation, " Let us try this or the other operation ;" and in difficult circumstances the surgeon has often been known to make an incision into such an uncertain tumor, merely to learn what it contains. This inquisitive incision is often made without even the ceremony of a tourniquet about the limb, and when, to his utter confusion, the blood of the popliteal artery dashes out upon the operator, and the patient faints, he, in hurry and trepidation, " ties strings about the limb," and proceeds straightway to perform amputation, notwithstanding the absolute assurance of the limb being safe! For if the main artery be thus lacerated, and the limb still survive, what doubt can there be that the inosculating arteries are enlarged, and that the limb lives by them alone? Indeed, the reason which surgeons give for cutting off the limb, viz. that of being assured by the incision that the main artery is actually ruptured, is the very reason why they should attempt to save it.

Fourth, To finish all, When ignorant surgeons cut off such a limb, they, after dissecting it, describe to us a burst artery, with all its consequences, as coagula of blood, matter like coffee-grounds, diseased muscles, carious bones, and a corrupted joint! nothing in their dissection is wanting to prove the disease to have been a regular, but long neglected aneurism! But they call it an anomalous case, as if they were anxious to prove that they have learnt nothing more from their dissection than from their previous inquiries into the history of the disease.

Fifth, You will perhaps say within yourselves, "What should we do, to acquit ourselves faithfully, in so difficult a situation?—Reflect much upon the history of your patient's disease, write it down, ponder upon it, compare it with the descriptions of authors, it is a disease in which you never need be hurried into any imprudent act. Remember how frequently arteries are burst, how slowly aneurism forms, and that when confined in a narrow cavity like the ham, or when buried under the thick muscles of the thigh, when the sac is old, and crammed with firm coagula of blood, aneurism may lose its pulsation. Do not forget this general rule of surgery, which I have ventured to lay down, "Allow no tumor to grow to a dangerous size." If a tumor have its seat about the throat, near the carotid arteries, or under the angle of the jaw; if it be in the groin, in the thigh, in the cavity of the ham; and most especially if it be at once near a great artery, and a joint such as the knee, deal with it early, and you will often in the course of your practice have the happiness of preventing those afflicting cases which defy surgery.

Sixth, In this particular disease, first assure yourself of its nature, submit yourselves to the advice of your fellow surgeons, open the tumor early, but not like those ignorant men who are terrified at the sight of blood! When the coagula roll out, you may be assured that an artery will bleed in the end; when you have cleared out the blood and let go the tourniquet, you will see the artery; when you perceive that the main artery is wounded, the limb being still alive, you have reason to believe that the collateral arteries are enlarged and the limb safe, that you have but the common dangers of all such cases to encounter, viz. sloughing, fever, and weakness. When the artery is but a branch, as the tibial artery, you may tie it with the greater confidence; indeed, it is only when the joint is injured, or the bones carious, that you have to cut off the limb. When you see the mouth of a bleeding artery, you should, in general, tie it with the needle, for it lies deep; when you find no artery, but observe a slow hæmorrhagy from a vein, a piece of scraped lint is sufficient; when there is an oozing of blood from a deep part of the cavity, and from uncertain vessels, you may thrust down a piece of sponge.

This neglected aneurism is the Anomalous case of Medical Collections, it is a disease for which Mr. Pott can find no other terms of description than these: "A tumor which has its seat in the middle of the calf of the leg, or rather more towards its upper part, under the gastrocnæmius and soleus muscles; it begins by a small, hard, deep-seated swelling, sometimes very painful, sometimes little so, and only hindering the patient's exercises; it does not alter the natural colour of the skin, at least till it has attained a considerable size; it enlarges gradually, does not soften as it enlarges, but continues through the greatest part of it incompressibly hard, and when it has got to a large size it seems to contain a fluid which may be felt towards the bottom, or resting, as it were, on the back part of the bones; if an opening be made for the discharge of this fluid, it must be made very deep, and through a strangely distempered mass; it either derives its origin from a bursten artery, or at least is always accompanied by it; this is a complaint affecting the leg, removeable, as far as my experience goes, by amputation only." A certain cure, God wot, and perfectly chirurgical.

But I must now conclude this discourse, of which the purpose has been to instruct you in the various causes of aneurism. You will no doubt have observed, that how much soever we may attribute to predisposition, aneurism arises more frequently from violence than disease; that it is not from any weakness, or from its dependent posture, that the lower extremity is peculiarly subject to aneurism. Though the muscular force of the leg is infinitely greater than that of the arm, the artery of the leg cannot have power proportioned to the muscular exertions of the limb, and the lower extremity is actually prone to aneurism from its superior strength! the artery of the thigh is disposed to this disease by being long, tortuous, and subject to the pressure of the strongest muscles in the body; the artery of the ham is endangered by the manner in which it perforates the tendon of the triceps muscle, by its loose unsupported condition where it arrives in the ham, by its lying upon the capsule of the joint, and by the manner in which it is enclosed, between the two projecting condyles of the thigh bone.

You must have observed too, as I enumerated the causes of aneurism, that women are exempted from it, not because of the softer texture of their solids, not because their arteries are less predisposed, (for I have found examples of the crisp, thickened, and dilated artery, and of diseased and ossifying aorta, with every other mark of predisposition, more frequently by far in the bodies of women than of men), but because they are almost exempted from labour; their muscles are incapable of dangerous exertions; they live a quiet life; their business, their duties, their amusements, are all domestic. I have not seen, nor read, nor heard of one woman having an aneurism in the ham.

Men only, and those the strongest of their sex, coachmen, porters, soldiers, have aneurisms. It is from the soft luxurious habits of men in the higher ranks of life that they escape; men like women are indeed exempted from this disease. It is from the superior strength and active labours of men in the lower ranks of life that they are subject to this disease. Nor is it constant labour and the perpendicular posture that weakens the arteries, as it dilates the veins. Occasional, sudden, and bold exertions, only endanger the artery; it gives way sensibly in the very time of the strain; and the pain from that moment never ceases till the limb is swelled to bursting, the joint immoveable, and the bones destroyed.

It is by the surrounding cellular substance, the closeness of the surrounding parts, and the firmness of its own peculiar sheath, that an artery is so long supported and forms its sac so slowly after being thus lacerated. It is by occasional exertions of the limb, and successive hæmorrhages from the artery into its cellular sheath, that the aneurism increases from time to time; when enlarged to a certain size, aneurism becomes irresistible, and in the last weeks its progress is inconceivably rapid. When in the thigh, the disease has sometimes been spontaneously cured; but when lodged under the joint it is almost inevitably fatal.

I hope I have laid before you the materials for study, and taught you a habit of reflecting and deliberating upon the nature of this disease.

DISCOURSE VI.

ON THE CONDITION OF AN ANEURISMAL LIMB, FROM WHICH IS DEDUCED THE SAFETY OR DANGER OF THE VARIOUS OPERATIONS FOR THE CURE OF ANEURISMS.

We are now entering upon important speculations, and I must begin by again representing to you the condition of an aneurismal limb. For some weeks the great aneurism of the thigh increases with alarming and awful pulsation. The tumor is hard, firm, and painful, the pulse throbbing and feverish, and the aneurism begins to inflame. The lymphatics and the great veins accompany the artery, and by the size of the tumor they are so compressed, that the whole limb swells, and the particular tumor of the aneurism is almost concealed by the general turgescence of the limb. The limb now lies out a heavy unwieldy mass; the tension of it is very distressing; the cramps are frequent and terrible; the only motion in the limb is a sort of trembling and convulsive twitching; the numbness is even more distressing than the actual pain; the man lies extended on his back, with great anxieties, unable to move his limb; he has restless nights and fearful dreams, and when the disease approaches to its last stage, he is quite exhausted with fever and pain.

The last stage approaches in which the particular tumor now emerges from the general swelling of the limb; and in proportion as the proper aneurismal tumor rises, the pulsation, or rather throbbing of the whole, becomes irresistible. If the aneurism were in the breast, the very bones at such period would be burst asunder. The skin begins to change its colour, the circumference is dark and inflamed, the centre is livid, all the upper part of the member is one great throbbing tumor! while all below is cold, insensible, powerless, and swollen as with a dropsy. Now comes that eventful period, which the patient seldom survives; the signs of gangrene and death approach; the thigh becomes livid; the pulsation ceases; the gangrene seems begun. The limb itself is paralytic, cold, heavy, dead; the patient lies in that lethargic torpor which precedes death, and nature contends whether he live or die. But gradually the patient recovers from this deadly slumbering; the low delirium goes off; the fever subsides; the limb recovers its natural heat; the activity of all its vessels seems to be renewed; but the pulsation in the tumor and in the course of the tumor is gone! The general swelling falls by slow degrees; the crammed and solid hardness of the limb gradually softens; yet half a year generally elapses before it is reduced to any seemly shape, or to any thing near its natural size. When the aneurism first loses its throbbing, it is a sign that the great artery is oppressed, soon to be obliterated, which obliteration is accompanied sometimes with death of the member, sometimes, though rarely, with a renewal of life. When the limb recovers its natural heat, without any renewed pulsation in the aneurism, it is a sign that the main artery is obliterated, the collaterals enlarged, and the limb safe; and as the limb gradually softens, we can, in the progress of the cure, force the points of our fingers down into the bed of the artery, and feel the remains of the aneurism and of the obstructed vessels like a firm and knotty cord.

This description of the disease shows the nature of those sufferings of which the patient often dies without bursting of the tumor, or loss of blood. Sometimes the tension of the limb is such that the cramps rise to the violence of convulsions, the patient expiring with a general convulsion of the whole body, along with slighter tremblings of the affected limb. Often the continued fever, the pain, the want of natural rest, the horrid dreams, and the delirium produced by this scene of misery, proves fatal. Sometimes though the whole limb is not tainted with gangrene, the aneurism itself becomes gangrenous, and the patient falls into the low delirium and dies. Usually the lividity of the aneurism increases, the skin becomes thin, inflamed, dry, and chapped; it cracks; bloody serum oozes out; sometimes there is a detached eschar supported by a clot below, rising and falling with each motion of the pulse; at last it bursts, and at one gush he loses two or three pounds of blood; he lies in a low and muttering delirium during the night, recovers somewhat in the morning, but is sick and languid, and with the next slight gush of blood expires.

But sometimes the pulsation having ceased, the limb becomes cold only for a time, the heat returns, and the patient is saved. There is a certain critical point to which, when the aneurism arrives, the struggle betwixt the pulsation and the resistance must end suddenly. If the pulsation is to prevail, the parts become thin, the tumor bursts, and the patient expires. If, on the other hand, the resistance be such as to oppress the artery, then the pulsation does not all at once cease, but the collateral arteries enlarge, and begin to carry off the blood from the aneurism, at the very moment it threatens to burst. By this change of circulation, the pulsation of the artery is weakened, so that the swelling, weight, and resistance of the surrounding parts, and of the coagula formed within the aneurism, are able to resist the stroke of the artery; its pulsation flags, and the collateral arteries enlarge; its pulsation at last ceases, and there is to be observed betwixt the loss of one circulation and the establishment of another, an interval of coldness and deadness in the limb. The circulation is thus for some time upon the turn, and when this critical period arrives, the limb is prepared for the happiest changes, and no sooner is the circulation in the great artery stopped, than that of the collateral arteries is substituted in its place.

But if this natural aneurism of the artery burst, the blood can no longer go along in the same course; the artery being burst, its blood is poured abroad into the cellular substance; the vessel itself is obstructed by the coagula, and oppressed by the continually increasing tumor; if the skin also burst at the same time, the patient expires. But where the skin resists the aneurism a few days longer, the circulation in the main artery ceases, the artery itself is flattened and compressed, the collateral arteries enlarge, and the limb recovers from the interval of cold and numbness; the skin and cellular substance give way a few days after, but there is no loss of blood, because the channel of the main artery is already dry; and though the patient may die, exhausted, yet the limb is safe. If it unfortunately happen that in the moment of this turn in the circulation of the limb, the surgeon takes the alarm, calls a consultation, and cuts off the limb! he finds that three or four arteries bleed from the interstice of each muscle, ten or twelve arteries bleed from the general surface of the stump; he has the mortification to perceive that he has cut off the limb in the very moment when nature was providing for its safety; his patient dies on the third or fourth day, from causes which I shall presently explain.

This enlargement of all the smaller arteries implies a condition of an aneurismal limb, which, though hitherto unnoticed, is too full of important conclusions to be but slightly explained; and the condition of the aneurismal limb is still the same, whether we perform the cure by tying the artery, or attempt it by compression, or whether we neglect the aneurism till it obstructs the artery and obliterates it by its pressure, or bursts inwardly among the cellular substance. And I will undertake to prove to you, that it cannot be a matter of indifference to operate upon a limb in this condition.

When the celebrated Guattani found that the operation for popliteal aneurism was hardly practicable, and amputation itself no sure refuge, he began to turn his thoughts towards the medical cure of aneurism! he hoped to invent some way of resolving the aneurism by compressing the tumor itself, and diluting the blood contained in it. He at last succeeded in curing aneurism by long confinement, with compression and firm bandaging; and he believed that he had repressed the aneurism, and actually saved the channel of the blood, by preserving for it a free course through the main artery of the limb. I know it was universally the opinion of those great masters that they saved the channel of the artery, but I resort to their works, not for their opinions, but for their facts; and, to be plain with you, the more I study their facts, the more am I hardened in this infidelity with regard to their opinions.

Guattani was fully persuaded that he resolved the blood, squeezed and melted down the coagula, returned the fluid parts into the circulating system, cleared the artery, repressed the tumor, and preserved the circulation through the main trunk of the limb. I need hardly quote passages: I do not need to search curiously for proofs of this doctrine; it was his only one, and every expression in his book involves some proof of it. "When I reflected particularly," says Guattani, "on those aneurisms which occur in the limbs, I began to imagine, that by confinement to bed, by reducing the habit of the whole body, by compressing the artery so as to prevent the full flow of blood towards the aneurism, and by a gradual, steady, and slowly increased pressure upon the aneurism itself, I should be able, not only to prevent the further growth of the disease, but to accomplish in time a complete resolution of the clotted blood into serum, thin enough to return into the course of the circulation, and thus to disperse the tumor altogether." Guattani succeeded often in curing aneurisms of the ham by compression, and when he failed, his disappointments are acknowledged so freely, as to prove him to be a truly great man. His successes were unequivocal, but the process by which he accomplished the cure is far different from this resolution of the blood which he imagined. He performed the cure by spare diet, rest, compresses, and a well rolled bandage continued for months; and I suppose these to have been the effects of his method. First of all, this kind of pressure resists the further extension of the tumor, and the bandage, though severe at first, never fails, in a little while, by opposing the extension, to relieve the pain. In the next place, the artery being resisted in this outward direction, the limb is brought suddenly, but simply, into that state which is so dangerous in the last stage of aneurism, for by this pressure the artery is opposed, the circulation is less free, the blood is turned towards the collateral arteries, the limb remains for a few days cold and numbed, and is gradually prepared for the final cure. It is essential to your understanding this cure by compression, that you observe the following fact: Aneurism is not what it has been represented, a fair round bag containing fluid blood, communicating freely with the artery; no aneurism is truly reducible by pressure; aneurism is hard and firm, even of a stony hardness; were it otherwise, how could it resist compression for months? The aneurism, whether true or false, is filled with solid knotty coagula, and resists perfectly. The very tumor itself serves as a compress for the artery, the pressing down such tumor compresses the artery betwixt it and the bone, and this is the true reason why a simple compress and a general roller cures aneurism, without those cunning screws and cushions which the older surgeons invented so ingeniously for making a partial compression. The aneurismal tumor being itself hard and firm, conveys the compression to the main trunk of the artery, which is compressed betwixt it and the bone, while the collaterals lodged among the sound and fleshy parts escape the pressure.

Were the opinions of those pathologists correct, that the blood were resolved, the aneurism repressed, and the canal of the artery preserved, the tumor should yield at first, then become flaccid, then its blood should be altogether discharged into the artery, and the artery should be apt, on removing the bandage, to inject the empty bag and fill it again; in short, the sac of the aneurism should be repressed as a prelude to the cure of the disease. Again, suppose (by some process of the economy, which I cannot foresee, and which surely never did happen), that this were really the succession of the phenomena in this cure, the artery after such a cure should carry its blood freely, the pulse should be as strong as ever, and whatever remained of the tumor, though it were but a thickening of the parts, should receive the stroke of the artery, and this residuum or remains of the tumor continuing to pulsate thus, the operator never could be assured of his cure, and would never lay aside his compress.

But, in truth, the last stage of the process is this: The artery being for some time opposed by the gradually increasing tension of the parts, the blood is thrown upon the collateral branches; the blood passing along the collateral branches allows the compression to be increased, without that intolerable sense of numbness and pain which the compressions of the first week causes. At last the compression is supported boldly, firmly, unremittingly. If the operator stop short of this, the disease returns; but if he entirely compress the artery, the blood forsakes it, the pulsation stops, the tumor remains solid and firm, and does not enlarge, because the blood no longer flows into it, nor does it even beat again, because the artery which lies under it is obliterated by the pressure. The artery is obliterated for months before the pulsation ceases, but the tumor never entirely disappears; there always remains in the ham a knot so firm as to resemble an exostosis of the bone, and so attached to the joint as to cause a degree of stiffness. It is only from ignorance of this process that the operator does not leave off his compression, when the tumor becomes stationary, when the pulsation ceases, when, in short, the artery is obliterated; it is often continued, on the contrary, till it produces rigidity of the joint. Thus, we perceive, that Guattani, when he cured by compression, had no reason to continue his bandages for years, nor to fear a return of the disease. He performed, in fact, a radical operation, he obliterated the artery as fairly as if he had tied it with the four tapes which have been so often used in this piece of surgery. But I will relate the manner in which he performed his cures, and you shall judge yourselves whether the aueurism was repressed merely, or whether the artery was absolutely destroyed.

"A porter, about forty years of age, of an athletic and sanguine habit, had an aneurism of the ham as large as the biggest goose egg, hard, elastic, pulsating very strongly, with fever, and a general swelling of the limb. Guattani had resolved to perform the operation for popliteal aneurism, but was willing to defer it till the swelling should subside. He laid the patient in bed, bled him and kept him to a very spare diet, and this was providentially so singularly useful, that not only the increase of the disease was arrested, but in the course of little more than a month, the pain entirely ceased, the violence of the pulsation was somewhat abated, and the general swelling was very greatly lessened.

"Having to accompany the Pope during his retirement in the autumnal season, Guattani thought it advisable to delay the operation for three months; but finding upon his return the tumor nothing larger, and the general swelling of the limb quite gone, he resolved to try the compress and bandage. He formed two long compresses, crossed them over the centre of the tumor in the ham, and made their ends encircle the knee above and below. He laid, also, a compress up the thigh, along the course of the femoral artery, and with a very long roller, three inches broad, he encircled, first the knee, and then the thigh, finishing with one turn round the pelvis to keep it firm; from time to time he poured spirits of wine on the bandages, which, when well applied, kept firm for eighteen or twenty days. Every time they were renewed he drew them a little firmer.

" Though the tumor long preserved its form, hardness, and pulsation, yet in the course of exactly three months the patient left the hospital perfectly cured; nor was any thing of this great tumor left, except a sort of callosity or hardness of the size of a bean. He returned to his business of a common porter, paid no attention to his diet, strained frequently under the heaviest loads, yet never had the slightest return, nor felt any greater inconveniency, than a trifling swelling of the foot and ancle."

Thus does Guattani affirm, in direct terms, that the canal of the popliteal artery is preserved. But we shall judge, perhaps, more decisively of his doctrine after reading another case, where, though the process of the cure is the same, the relation of the phenomena which attends it are somewhat varied.

" The second cure was performed upon a man of forty-five years of age, a grave-digger. His aneurism was large, with pain, fever, a throbbing pulse, and great swelling of the limb, but not particularly hard; you rather seemed to feel in it a sort of fluctuation. But the cause was well marked; for " in the last week of July, he had hurt his limb in a very violent effort; it was while he strained very hard in lifting the confession-desk from one part of the church to another, that he felt something give way in his ham, with a sudden pain, but yet bearable, so that he was able for some time to continue his labours. He was ignorant of the nature of his disease, and had used only the more harmless applications, till the time of his being laid in the Hospital of St. Peter, under Guattani's care.

" This man was brought to the hospital in the first week of August. For the first eight days he was bled, dieted, confined to bed, and reduced so that the stricture of the bandage might be safe and tolerable. Then the compression was begun, carried on step by step, and occasionally renewed; but on the first week of November Guattani found that the pulsation of the tumor had entirely vanished, and the tumor remained moveable." " Yet I failed not," says he, " to renew the compression, and with such happy success, that by the middle of January my patient left the hospital perfectly cured, excepting a halt in his gait, and that not remarkable." " Two months after I sent for him to examine the parts, when I found in the ham nothing but a small hardness, about the size and shape of a chestnut, resembling an exostosis."

There cannot be imagined a more correct history of an artery obliterated by compression. The patient was bled, and purged, and confined to bed, which relaxed the parts, and the tumor was so compressed, that in the course of one month the pulsation disappeared! The pulsation had disappeared, though the tumor remained, which shows that there was not pulsation enough in the artery even to raise the tumor. The tumor was now moveable in the ham, yet nothing is said of its connexion with the artery; there was not even the slightest pulsation in the artery, to remind Guattani of that connexion betwixt the now pervious artery and remaining tumor, which otherwise he would have described with so much care. He next performed a work of supererogation, for the artery was obliterated, the pulsation gone, the rest should have been left to nature; but he applied his compress and bandage again, and in the two succeeding months did no more than stiffen the ham.

But desirous, after two months, of knowing the state of the parts, he sent for his patient again, examined the ham; and now he found that he had compressed the aneurism into a hard and bony knot, and had so fixed the tumor, formerly moveable (fluitantem), betwixt the condyles of the thigh bone, that it resembled an exostosis. Here again a new state of the tumor is described, at the distance of three months from the time of the cure, and yet not one word of the artery nor its pulsation, no curious distinctions betwixt the pulsation of the artery now in its natural condition, and the diseased pulsation which it had during its aneurismal state. Here is described a tumor, firm in its own consistence, and fixed to the joint and bones like an exostosis. How could there remain any canal, artery, or vein in the ham under this tumor? We may be assured, that in this method of cure by compression, just as in the radical cure by ligature, there is an entire change in the circulation of the limb *!

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* In a note in the first volume, I have stated that the blood may return into the trunk of the artery between the part where the ligature is applied and the tumor. When my brother wrote, an opinion prevailed that an aneurism was cured, sometimes spontaneously, by the healing of the rupture of the artery, and that when an aneurism was cured by compression, it was still by healing the wound of the artery. He argued, and proved, that when compression had the effect of curing the aneurism, it was in consequence of the obliteration of the artery at the point compressed; but another question has arisen since his time, in respect to the condition of the artery betwixt the point operated on and the tumor of the aneurism. It was generally supposed, that the artery below the ligature, and the sac, were obliterated; that this is not always the consequence, I proved by the dissection of a limb in 1806, on which the operation for aneurism, as recommended by Mr. Hunter, had been performed; I found the artery betwixt the point tied and the tumor, pervious and active. The conclusion I then drew from this fact, was that the effect of our operations was only to diminish the impetus of the blood passing through the sac, and in this way to admit of the coagulation of the blood. In pursuance of this view, I strenuously urged the propriety of tying the artery below the tumor, i. e. farther from the heart, in cases where the operation above the tumor would be difficult and dangerous.

This operation had been proposed by Dessault, in the hopes that the circulation through the sac might be completely stopped, and thus permit the blood to be coagulated. But in an operation performed by Deschamp, the progress of the disease, instead of being checked, appearing to be accelerated by tying the artery below the tumor, the plan was abandoned. The idea which universally prevailed, that to ensure success the circulation through the tumor must be completely stopped, was another cause for the proposal being considered by many as a mere speculation. Only one case occurred to me where I considered myself justified in recommending this operation; it was a case of aneurism of the subclavian. I proposed the operation, but the patient was persuaded by another surgeon not to submit, and died by bursting of the tumor. But the practicability of the operation has been happily proved by Mr. Wardrop, who has lately tied the carotid artery beyond the aneurismal tumor.

So great has been the success of the operations on the external iliac artery for aneurisms high up in the thigh, that I do not think we are warranted in tying the artery below the tumor in such cases;

Let us next observe, whether we have not the same marks of obliteration of the artery, even in those cases of spontaneous cure where the surgeon thinks

and in addition to the strong argument afforded by the successful issue of the operation of tying the external iliac artery, for continuing to do so, we may add the danger of exciting the aneurismal tumor by incisions made below it to reach the femoral artery.

Mr. Wardrop joins in the opinion generally expressed, that the sac of an aneurism and the artery become obliterated by the application of the ligature, and that, therefore, "the ligature should be made as close to the tumor as possible, in order to preclude the chance of leaving a branch between the tumor and the ligature which would carry on the circulation; and I can even conceive cases wherein it might be practicable to tie such branch separately, so as effectually to prevent the circulation being carried on through the aneurism."—Med. Chir. Trans. vol. xiii.

This anxiety to endeavour to stop the circulation entirely, will probably be the cause of an increase of danger to the patient. That it is not necessary to stop the circulation through the sac, but merely to diminish its impetus, to ensure success, is put beyond a doubt by the description given by Mr. Shaw, in the third edition of his Manual of Anatomy, of a preparation in the possession of Mr. Soden, of Bath. Mr. Soden tied the iliac artery for an aneurism of the femoral artery; the patient was cured, but about two years after he died suddenly of aneurism of the aorta. On examination of the thigh, the aneurismal sac, though very small, was still pervious; the circulation had gone on through the artery. An instance, also, occurred this winter, of a popliteal aneurism returning about four years after the femoral artery had been tied, which affords a most unequivocal proof of the part of the vessel between the ligature and the tumor not having been obliterated. The patient was operated on by Mr. Gunning, in April 1821; in June, the swelling in the ham was so small, that he was discharged as cured: the man was re-admitted in July 1825, with a return of the disease; he stated, that the tumor had entirely disappeared a short time after he left the hospital, and had returned only about six weeks before. The leg was amputated by Mr. Jefferys, at the part between the tumor and the point where the ligature had been applied. A large artery presented on the stump, which proved to be the femoral, and was tied with eight smaller ones. On examination of the amputated limb, it was found that the popliteal artery was pervious, and that the aneurism had been reproduced.

This may, perhaps, be considered as a proof, that the freedom of inosculating branches may prevent the success of our operations; in some cases it may do so, as where the aneurismal sac is large, that the canal of the great artery is still pervious. Mr. Blagden, surgeon at Petworth, was consulted by a man of about fifty years of age, tall and muscular, who had his humeral artery wounded in opening the basilic vein. The blood flowed in great quantity, per saltum, and was stopped by strong compression. First an ecchymosis extended itself generally from the shoulder to the wrist; then the aneurismal tumor formed, and in six months it had increased to the size of a cricket ball. The arm was oppressed, cold, shrunk, and, as the patient expressed it, painfully lifeless; he was advised to have the operation performed, but he first thought of consulting Mr. Blagden.

Mr. Blagden found the aneurism of this great size, hard, with a strong pulsation in it, but the fore arm below was cold and pulseless. Now the patient had

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inflamed, and disposed to burst; but as the case just related is almost unique, I do not suppose that we have any thing to dread from the freedom of the inosculations in nine cases of ten of popliteal aneurism. The following very extraordinary case will prove, that the blood in the sac of a popliteal aneurism will coagulate, although only one-half of the current be interrupted in its direct course. About six weeks ago, I performed the operation for popliteal aneurism on a Black; the moment the artery was tied, the patient said the beating in his ham had stopped; the difference in the feel of the tumor was also evident to Mr. Shaw at the moment, but even before the patient was taken off the table, the pulsation was perceptible. On examining the patient, as soon as he had rallied and got warm in bed, the tumor was found beating strong as ever, and continued so until the third day, when it became fainter, and on the next day had entirely ceased. The wound was attacked with erysipelas, the lungs became affected, and on the sixth day the patient died. On examination of the thigh, the femoral artery was found to have bifurcated at the groin. Two superficial femoral arteries, of very large and of equal size, ran down the thigh, and united immediately before perforating the triceps. Only one of these arteries was tied, and still the pulsation in the tumor had stopped, and the blood was coagulated!—C. B.

assured Mr. Blagden that the tumor had been larger, that it was subsiding, that the pulse in it was somewhat abated; and Mr. Blagden did not scruple to advise that he should wait the issue of these changes, rub the arm with the flesh-brush, and refrain from exertions.

In a few weeks the arm grew a little warmer; in about three months he began to be sensible of a tremulous pulse at the wrist; the tumor gradually diminished, and the strength of the pulse at the wrist increased; in eight or ten months the tumor in the bend of the arm was reduced to the size of a hazel nut, while the pulse at the wrist was quite restored, and the arm as full and fleshy, as capable of as powerful exertions, as the sound one, but he was desired to avoid such exertions.

The author concludes with this sentence: "It is too evident to admit of any doubt, that the circulation is carried on in its usual course through the artery, and not through the lateral anastomosing branches of it."

I am well assured, that in this case the blood passed only through the anastomosing branches; the profunda and ramus anastomoticus were enlarged, the trunk obliterated, the circulation along the fore part of the arm gradually subsided in proportion as the vessels upon the back part enlarged; and I found my opinion upon certain expressions of the author, very clear, I think, and intelligible, and which I shall presently quote.

When an aneurism grows to so uncommon a size as this, it is implied that the artery is largely wounded; but still, being supported by clots and by the resistance of surrounding parts, it transmits a tolerable proportion of blood. When the aneurism arrives at the size of a cricket ball, the disease must take a turn; the forces of the pulsating artery and of the tense aneurism lying over it are nearly balanced, and either the force of the artery must overcome the resistance of the surrounding parts, and the aneurism burst, or the resistance of the parts must suppress the action of the artery, and then the inosculations must enlarge. If the artery be largely wounded, it will throw out much blood, it will form a very large tumor, but it will not have force to push that tumor beyond a certain extent. The artery thus wounded being little able to transmit blood for the nourishment of the arm, the inosculating arteries will enlarge, the impetus of the main artery passing under the tumor will be gradually lessened, while the resistance of the tumor will be still the same, the clots will become firmer by the absorption of the thinner parts, and the cellular substance will become thicker by successive inflammations. The fascia in the bend of the arm, naturally strong, will now be greatly thickened; the resistance of the tumor and the action of the artery being thus balanced, the one will soon overcome the other, the pulsation in the aneurism will flag, the course of the blood through it will relent, the arm below will be for a time cold and powerless, and as the blood does not pour, as before, into the aneurismal sac, the size of the aneurism will begin to diminish almost as soon as the pulsation of it subsides; then the collateral arteries will enlarge, and the spontaneous cure thus begun will end in the total obliteration of the main artery; the recovery of heat in the lower part of the arm, and the pulse (fluttering and hardly sensible at first) will be slowly re-established.

Those various steps of the process are perfectly marked in Mr. Blagden's relation of the case. First, When he saw the aneurism, it was large as a cricket ball, the arm below was oppressed, it was "painfully lifeless," there was no pulse in the wrist, and the tumor was beginning to decrease in size! The forces at that period were divided, and the inosculations were beginning to enlarge. Secondly, Within a few weeks the arm grew warmer, he could perceive a tremulous kind of motion at the wrist, the tumor very gradually diminished, the pulse in the tumor grew weaker, and the motion at the wrist strengthened in proportion as that at the bend of the arm subsided! Is this the way in which the pulse of the wrist should strengthen, if the blood by which that part of the artery was filled, was conveyed by the main artery through the bend of the arm under the tumor? Lastly, "The tumor grew hard as it diminished in size; when reduced to the size of an apple it was perfectly incompressible; it was thought to have become perfectly stationary, but in the course of eight months it was reduced to the size of a hazel nut, and lost much of its hardness." This is just the description of an obliterated artery. In this passage not one word is said of pulsation in this remaining tumor, nor of the free action of the artery lying under it in the bend of the arm! In a tall and muscular man, such as this was, I think I could undertake, after this spontaneous cure, to point out the ramus anastomoticus, in its enlarged state, turning under the inner condyle of the os humeri.

CONCLUSIONS.

Thus we see, that when a great artery is diseased or wounded, and an aneurism formed, there is no cure but that of the entire obliteration of that artery; and by whichever method we accomplish the cure, obliteration is invariably the effect.

Whatever physicians may have believed of their ponton, or bridge-like compress, affecting, as they supposed, the tumor only, and yet allowing the blood to pass along the artery; whatever they may have believed of their well-contrived springs and cushions for partial pressure; whatever the old surgeons may have attributed to those sponges, vitriol-buttons, pellets of chewed paper, or morsels of agaric, which, after cutting open the aneurism they applied to the wounded artery; in truth, they cured by compressing, destroying, cauterising it, and, one way or other, obliterating its canal; and I have just proved, that whatever the celebrated Guattani believed concerning the effects of his bleeding, spare diet, confinement, and well-supported compression, yet, in fact, he also obliterated each artery; and we may now take a slight review of the phenomena which present themselves according to the various ways in which this process of obliteration is effected*.

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* Experiments have been made, both by English and French surgeons, of puncturing the artery with bodkins, and where it has been found that such wounds closed again. But these experiments do not affect the reasoning or the conclusions drawn here.—C. B.

First, If we tie the main artery of a limb, its blood being suddenly interrupted, the limb is cold for a moment, but its heat and circulation soon rise above the natural standard. The blood no longer passing along the main artery forces the collateral arteries; these are excited to a high action, the limb becomes turgid, the animal heat rises high above the natural standard, and the limb continues for some days in danger of gangrene from intense circulation; but never does it approach in the least to that dry and cold gangrene from want of blood, which has always been so much feared! which has been, to the great loss of society, represented as the sure consequence of interrupting the main artery of a limb.

Secondly, When we compress an aneurism, the tumor itself is forced back upon the artery, the action of the main artery is suppressed, while the collateral branches are forced to receive its blood. When occasionally we intermit the compression, the blood returns to its old channels and the pulsation of the aneurism is renewed; but, by persevering in the compression, that channel is quite obliterated, and the cure is accomplished when pulsation ceases on the fore part of the limb. Now, if this manner of obliterating the artery be not accompanied with the same interval of coldness and deadness of the limb that we are sensible of in using the ligature; if the same perceptible heat, turgescence of the limb, and high action of all its vessels do not succeed, it is because the tide of blood is more slowly turned, the collaterals slowly enlarged, and the course of the blood along the old channels is occasionally restored, in consequence of intermitting the compression at times, which happens rather from the accidental slackness of the rollers than from any premeditated design.

If this cure by compression be more successful in the aneurism of the ham, it is by the firm resistance of the bone against which the artery is compressed. If compression fails, and is sometimes dangerous in the thigh, it is because the bone is too deep to give full effect to compression, and the parts soft that they allow the aneurism to spread in all directions; for in such cases, compression, instead of stopping the blood in the artery, rather diffuses the aneurism, forces the cellular substance, and inflames the parts.

Thirdly, When the cure is spontaneous, the process is still the same, and the proofs of the obliteration of the artery are as sensible as if we had accomplished it by ligature or compression. The dilating force of the artery and the resistance of the surrounding parts of the muscles, or of the fascia (for every artery lies under fascia) are balanced; the accumulation of the blood and the elasticity of the fascia begin to oppose the pulsation of the artery at the very moment when some proportion of the blood begins to be thrown upon the collateral arteries. The resistance of the tumor is increasing, while the force of the artery is diminishing. If before this balance of the resisting and dilating powers be complete, and the aneurism burst, then the man is gone, he dies of hæmorrhagy; but if the balance be fairly turned in favour of the circulation (through the collateral vessels) along the back part of the limb before the tumor bursts, then the tumor bursts without hæmorrhagy; the arteries in all the lower part of the limb draw their blood through the collateral arteries, and the most indirect rout for the blood becomes the natural one. This spontaneous cure also is perfect only when the pulsation of the aneurism of the great artery on the fore part of the limb ceases, and the pulsation being gone, the absorbents perform their office, the limb returns slowly to its usual form. This cure is also marked by a firm tumor, which is the residuum of the aneurismal sac, and a knotty and cord-like hardness, which marks the place of the obliterated artery.

The enlargement of the collateral arteries is the leading point then in every cure. From the very commencement of aneurism the circulation through the main artery is in some degree prevented. That difficulty increases daily, and so perfectly is the limb prepared for a change of circulation, that cut it off at what period of the disease you will, the number of arteries will surprise you. In this operation by Mr. Harkness, fourteen arteries were tied with the needle; and in an amputation performed by Mr. Allanson*, you will find that there had been even a degree of confusion from the arteries. "The large artery was taken up," says Mr. Allanson, "without including the nerve; but this could not be done in all the others, which were numerous, for it was necessary to tie nine arteries."

What then is the condition of an aneurismal limb? is it in danger of wanting circulation? is it in danger of gangrene from want of blood? Quite the reverse; all its vessels are enlarged, while one only, viz. the great trunk, is destroyed or oppressed; the blood of the main artery is divided among innumerable small branches; the whole limb is turgid, throbbing with the intense action of these smaller arteries, now highly excited to work for the preservation of the limb; if, during this turgescence, this febrile state of the limb, you tie the main artery, the heat will immediately rise many degrees above the natural standard; above the temperature of the sound limb; if you cut off the limb, those arteries will bleed from every point of the amputated stump. This limb is not cold; does not need to be wrapped in flannels, nor rubbed with essential oils to solicit blood towards it; its vessels are in no danger of being forsaken, but rather of being oppressed with blood; the limb is indeed disposed to gangrene, but not of the passive kind! If you perform the operation of aneurism, the wound you make will often fall into gangrene, but never without previous inflammation; if you venture to amputate the limb, you are still in danger of gangrene, it seizes upon the stump, but never without previous swelling, nor does the gangrene happen till the fifth or sixth day*.

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* P. 262. This was an aneurism of the ham, which was occasioned by a fall from his horse in a young gentleman of a pale and sickly habit. He sprained his knee in falling; the aneurism had grown about four months, and was now beating strongly as if it would burst, and it was beginning to be diffused up the thigh.

There is nothing more certain than that this aneurismal state of a limb predisposes to every danger, and it becomes us to look well to the facts and reasoning by which such a doctrine is established, for its influence over practice cannot be slight.

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* See a former note on this subject.

OF THE SAFETY WITH WHICH WE OPERATE ON THE FORE PART OF THE THIGH.

The operation proposed by John Hunter, is one of the most important improvements in modern surgery, and one which only a great surgeon could invent. The superiority of this operation consists not in escaping that part of the artery which is diseased, for the yielding of the artery depends upon very different causes, and is to be prevented by precautions very different from this of changing the place of operation! I shall be able, indeed, to prove, that the artery of a young and healthy subject gives way almost as frequently as that of the aged or diseased. But, in Mr. Hunter's operation, you imitate the natural and spontaneous cure; the limb is prepared for that change, which you mean to complete by your operation; the main artery is compressed by the aneurism; the collaterals are enlarging; nature has begun a process with which it is dangerous to interfere, which you are to complete; you cannot with prudence make an incision into the diseased mass; you would not choose to cut the parts which are supplied with blood by those very inosculations which you wish to save. In Mr. Hunter's operation, you make an incision in the fore part of the thigh; there you tie the artery far above the aneurism; you stop the blood, and throw the whole circulation upon the inosculating arteries; you but complete that process which nature had begun, and leave the absorption of the tumor to time.

You make this small and superficial incision (hardly three inches in length) upon the fore part of the thigh, above the part of the limb affected with aneurism, and of course you have no thickness of parts to cut through, except what arises from the general œdema of the limb. Your first incision is through the skin, your next is through the strong fascia of the thigh; you encounter no inosculating arteries, you deprive the limb of no one blood-vessel, except the great artery, which it is at any rate about to lose, and which is already much compressed; you make no disorder in the limb, you touch no diseased part, you have no deep digging for the artery, you have no difficulty, no uncertainty in tying it, you run no risk of secondary hæmorrhagy, at least from the articular arteries; you make no incisions among parts which are choked with extravasation, where the muscles themselves seem hardly more alive than the coagulated blood which they contain; you expose no joint to ulceration, nor any bones to caries. Far from increasing those disorders which are within the injured part, you rather take away the cause of disorder, by preventing any further effusion of blood. Your incision is small, your way to the artery is direct; you feel your way by the pulse of the artery, and are assisted by your knowledge of the parts; if you be really an anatomist, you must perform this operation in a few minutes; if you be not, and dare to undertake such an operation, I know of no punishment too severe for such unprincipled conduct; no human reproaches can touch a mind which does not feel the punishment within.

OF THE OPERATION OF TYING A GREAT ARTERY; WHY THE LIGATURES SO OFTEN GIVE WAY; AND HOW THE ARTERY WILL BE BEST SECURED.

I proceed, then, to analyze the several operations which have been performed upon the femoral or popliteal artery, and shall endeavour to prove, First, That the more pains the surgeon takes in securing the artery, the more does he insulate the artery, destroy its vascular connexion with the surrounding parts, and endanger ulceration and bursting. Secondly, That the oldest method of all, recommended by the Arabians, and practised even by modern surgeons, viz. the cutting the artery across after it is tied, is in truth the only operation which can give to the artery tied in aneurism the security of an artery tied in amputation of the thigh. The first part of my duty, then, is to enumerate those faults in the manner of tying the artery, from which so many have lost their lives, and so many of the best surgeons have failed in their attempts to secure the femoral artery.

The English surgeons were among the first who attended to this important piece of surgery. Mr. Hunter suspected, that a diseased state of the artery was the cause of its giving way; for this reason alone did he change the place of operation; but even when he tied the artery on the fore part of the thigh, far from the seat of the disease, the artery gave way as frequently in his own practice as in the older way of operating.

This doctrine has universally prevailed, "That it would be better even to prevent the wound healing after the tying of the artery, and keep it open and in a state of suppuration, by which means the operator would have it more in his power to come at the artery, should that be necessary; he might also, in dressing this open wound, have it in his power, by gentle compression, to assist the ligatures *." This is professedly the principle of Mr. Home; and this most dangerous doctrine led directly to those very precautions which, instead of ensuring the obliteration of the artery, caused its ulceration and bursting; for, as it was thought advisable to lay compresses within the wound to support the ligature, it became important to have a considerable length of the artery exposed. The surgeon was too sensible, from experience, how apt this operation was to fail; and though he could not suppose that the laying much of the artery bare could contribute to its security, yet he wished to have a command of it; he wished to see it when it burst, and to be able to draw his ligatures again, or to drive his needles under it a second time, if necessary. Accordingly, he laid relays of ligatures under the artery, that it might never be out of his sight, although, in truth, till the artery be out of sight, buried among the flesh, it can never be safe.

Another theory still more subtle was this. The ligature, as some affirmed, should not be drawn tight; it should, say they, be straitened in such a degree only as to moderate the flow of blood through the artery, but without suppressing it altogether; or, to use Mr. Home's words, "A ligature being made upon the femoral artery impeded the passage of the

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* See an Account of Mr. Hunter's Operation, by Mr. Home.

blood into the sac so much, as to allow it in some measure to collapse, and its contents to coagulate*."

While theories were so very imperfect, the practice could not be good. There are two purposes here distinctly marked: First, That the surgeon should have it in his power at all times to open the wound, to look into the bed of the artery, to touch his ligatures, to draw the knots tighter when at any time they seemed loose, or to tie the occasional ligatures, when the first ligatures chanced to give way: Secondly, Since the purpose of the operation was not to interrupt, but only to moderate the flow of blood, it was judged better to accomplish this by a succession of ligatures slightly drawn, than by a single ligature firmly tied. The operation was, indeed, such as accomplished these two purposes perfectly; the artery could always be seen, the ligatures could always be found, the strings or tapes lay thus under the artery for fifteen or twenty days, and the artery thus insulated never failed to burst, so as to give the operator a fair opportunity of trying the strength of his occasional ligatures, and of adding, besides, whatever ingenious inventions he could fall upon.

The operation of tying the artery was performed by Mr. Hunter in the following manner: "Having disengaged the artery from its lateral connexions with the knife and from the parts behind it, by means of the end of a thin spatula, a double ligature was passed behind it by means of an eyed probe, and the artery tied by both portions of the ligature, but so slightly as only to compress the sides together; a similar application of ligature was made a little lower;" and the reason for passing four ligatures was, "to compress such a length of artery as might make up for the want of tightness, as Mr. Hunter chose to avoid great pressure on the vessel at any one part *." The result of this operation was what one might easily have prognosticated, viz. that the patient was in extreme danger of his life. "On the ninth day after the operation there was a considerable discharge of blood from the part where the ligatures passed out; a tourniquet was therefore applied on the artery above, which stopped the bleeding; and although the tourniquet was taken off a few hours after, no blood followed. The head of a roller was now placed upon the wound in the direction of the artery, which was not tightened more than was thought sufficient to take off the impetus of the blood in that portion of the artery." Thus we see, that the issue of this operation, even in the first and most successful case, was a bursting of the artery, from which the patient was saved perhaps by a clot of blood forming in the artery, maintained by the continual pressure of a half screwed tourniquet; thus we find the artery giving way, although tied far from the seat of disease; we find nothing in the narrative of the case implying, that the operator, while tying the artery, felt it crisp, hard, enlarged, or anyhow inclined to disease; we find

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* London Medical Journal, 1787.

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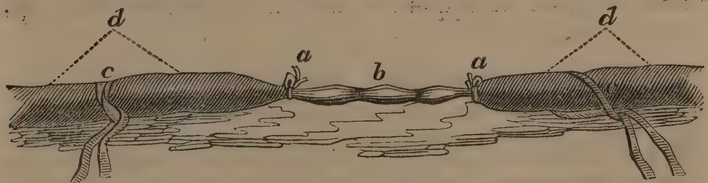
* An account of Mr. Hunter's operations for the popliteal aneurism, in a letter to Dr. Simmons, by Mr. Home, p. 395. Had Mr. Home reflected a moment on the manner in which his four ligatures came away, without the loops of them being cut; he might have learned, that they did something more than moderate the force of the blood.

the artery not giving way till the ninth day; and you will presently be satisfied that it is generally betwixt the ninth and the fourteenth day that the artery bursts, as if its bursting were the consequence of some regular process of inflammation and ulceration, and happened always at a certain stage of the disease; you will find the artery bursting always at the very time when, if tied and cut across, and put in the same condition with the artery of an amputated limb, it should be past all danger.

Next after Mr. Hunter, the inventor of the operation, Mr. Birch performed it in St. Thomas's Hospital; and he improving upon these methods of insulating the artery, seems to have stripped it down very carefully betwixt his finger and thumb. This was done in the case of one John Lewis, a negro, whose aneurism arose from a blow upon the fore part of the thigh. " After cutting the fascia," says Mr. Birch, " the finger and thumb could surround and compress the vessel; an eye-probe, armed with a strong ligature, was then pushed through the cellular membrane, and carried under the artery. This being effected, we had such command of the vessel as to be able to strip it down, and pass another ligature somewhat lower. The last ligature was then tied, the first being left loose to secure us against accidents." These unhappy contrivances for securing the artery, are in truth the causes of accidents. What was the issue, for example, of this case? On first reading it, we should believe, that the secondary hæmorrhagy of which the patient died had proceeded only from the bursting of the aneurism; but we soon see, that here also the artery itself had given way.

It was on the eleventh day after the operation that the patient expired; and upon dissecting the limb it was found, "that water, injected by the internal iliac artery, escaped freely from the wound at the ligature, where the artery was open, and appeared to have ulcerated at that part; and in slitting up the artery from the ligature to the heart, its internal surface appeared of a bright red." Thus the inosculations are in such cases enlarged, the heat restored, and the limb safe; gangrene is not the cause of death; the patients die of hæmorrhagy; they die not on the third or fourth day of gangrene; but on the fifteenth or twentieth day of hæmorrhagy; they are lost, not from the want of the provisions of nature against interrupted circulation, but from the imperfection of our operations *.



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* The condition of the artery, as tied with these successive ligatures, may be represented by this plate, where the ligatures (a a) are drawn firm, and have killed the piece of artery (b), where the ligatures (c c) are either drawn very slightly, to prevent the too violent impulse of the arterial blood against the others, or are merely laid under the artery, to serve in case of the artery giving way at the first ligatures. But the sure effect of such relays of ligatures is, to detach the part (d d) of the artery from the surrounding cellular substance; it must die along with the portion (b), or, falling into a state of ulceration, it will burst. The second ligature at (c) may then be tied, and will stop the artery for a time; but that part of the artery is inflamed, the part under the second ligature is in a state of ulceration; the process of ulceration, far

The report of this method of operating having passed over to Paris, the French surgeons of La Charité improved with singular ingenuity upon the mistakes of the English surgeons. They will pardon my allowing them only the second place, though they seem very well inclined to steal into the first, and to take to themselves the whole merit of these improvements, such as they are *.

M. le Comte invented a way of curing wounded arteries which has been admired as ingenious. He slit up a quill on one side, which, when unfolded he applied to the artery, and allowed it to close again, so as to encircle the artery; and in order to compress the wound of the artery with better effect, the quill was lined with a very fine ribbon, and the ends of the ribbon served for tying the artery. This proposal was received by the Medical Society of Paris with some degree of applause, and a committee was ap-

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from being stopped, will be accelerated by tying this second ligature, so that in its turn it also will give way, and the patient bleed to death. It would appear, that when an artery is once brought into this state of ulceration, the danger does not end with the failing of the ligatures; for in the second operation performed by Mr. Hunter upon a trooper, the ligature came away on the fourteenth day; on the twentieth a slight bleeding came on, and a few hours after the hæmorrhagy returned, and he lost a pound of blood before the tourniquet could be applied. The artery was then laid bare, and tied a little higher up, but too late, he fell very weak and low; on the twenty-third day he bled again, and on the twenty-sixth the bleeding returned, he became faint and delirious, hiccough came on, and he expired. This is a sad story. The patient was a young man; the artery was tied in the sound part of the thigh; it was tied, indeed, simply enough; but the cause of this hæmorrhagy is sufficiently obvious: "Upon examining the limb, sinuses were found running along the bed of the artery, upwards and downwards, and along the Sartorius muscle, besides smaller ones, i. e. abscesses in different directions.

* Vide Fourcroy, vols. ii. and iii.

pointed to make experiments. But the process which goes on in an artery thus insulated was not considered, or else the event of such experiments might easily have been foretold. An artery being thus surrounded with a foreign body and completely insulated, must undergo one of two changes: First, If firmly compressed, as when we apply the common ligatures, drawing them tightly, it would be not merely obliterated in its canal, but entirely cut across, and accordingly the ligatures would come away on the fourth or fifth day: Secondly, When thus encased in a quill, it would probably only inflame, its coats would thicken, the blood would coagulate above and below; the artery would continue alive, but by this inflammation and thickening of its walls, its calibre would be obliterated, and the course of the blood in it be as effectually stopped as if it had been cut across by a ligature drawn firm.

This accordingly was the issue of the experiments performed by the Committee upon Animals; they generally found the canal of the artery obliterated; it was only in one experiment that they were able to inject the artery after the death of the animal, and in that case too the artery was contracted at the place where the quill had been applied. In short, the effect of this operation, as of all others, was to obliterate the artery. We have even reason to believe, that if a wounded artery were ever cured by stitching the lips of the wound together, the cure would be accomplished only by inflaming the artery, swelling its coats, and obliterating its cavity; for that operation which was first proposed by Mr. Lambert of Newcastle, and afterwards repeated by me, has since then been repeated in the way of experiment by Conrad Asman, in presence of Bousch, Allardi, P. Driessen, and others. These gentlemen have invariably found the canal of the artery quite closed; and in pushing probes or Annell's wires along the course of the obliterated artery, they have usually found, that at the point where the wire was stopped by the adhesion of the coats of the main artery, the point of the wire turned off easily into a collateral branch, which was proportionably enlarged. Nor have they found the experiment to be even a harmless one, nor this way of obliterating the artery a good substitute for the ligature: for the inflammation which obliterated the artery at the part where the blood was no longer allowed to pass, sometimes proceeded to ulceration in the parts beyond, so that the artery burst, with a dangerous hæmorrhagy *.

It was next proposed by Mr. Persy, when the femoral artery was wounded, to cut a piece of sheet lead, slip it under the artery, and roll and bend it so as to encase the artery like the quill of Mr. Le Comte. This is another piece of ingenuity which must have been attended with still more serious consequences. The rudeness and weight of such a sheath for the artery, however it might have obliterated the wounded point, must have ulcerated the adjacent parts. This is a contrivance so coarsely mechanical, so directly opposite to those provisions by which nature secures a wounded artery, that it is the very thing one would have supposed in ridicule

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* In nostris quoque experimentis experte fuimus hæmorrhagiæ lethati ansam dare.

of these various methods of insulating the artery. It is a very singular proof, that the more ingenious surgeons have been in their mechanical contrivances, the farther have they departed from the principles of surgery.

When Mr. Duschamps had occasion to perform the operation for popliteal aneurism, he, like a man of honour and good sense, went into the Salle-des-Morts with his friends the evening before his operation, made various experiments, and settled with his assistants the manner of his operation, and all the steps of it. He, a man of knowledge in his profession, did what an ignorant fool would have been ashamed to do, tried the operation first on the dead body. Mr. Choppart, previous to an operation which he performed, had made trial of this piece of sheet lead, but was dissatisfied with it, and applied the ligatures in the common way. Mr. Duschamps also rejected it. "In respect," says Mr. Duschamps, "to the confidence which Mr. Lowis had, in this manner of securing the artery, I also made trial of it the evening before my operation, but whether from my awkwardness, or the imperfection of the method itself, my assistants disapproved of the experiment, and recommended it to me to hold to the old operation with ligatures."

But it was not from principle that Mr. Duschamps rejected this invention, it was not because of the dangerous effects of this rude contrivance in insulating and ulcerating the artery, he rejected this only to make way for a contrivance of his own still more mechanical, more complicated, more ingenious, and in proportion more dangerous. "A young man having wounded himself with a pair of scissars in the femoral artery, Mr. Duschamps unfortunately made a false incision, he exposed only the entire side of the artery! the side opposite to that on which the artery was wounded, the wounded part of the artery, could not be seen; and the artery was so well supported by its cellular substance, that it continued full and pulsating strongly. After long searching in vain for the wounded part, Mr. Duschamps applied a ligature at random, that ligature chanced to be below the prick in the artery, and no sooner was the blood thus opposed than it rushed out. This directed Mr. Duschamps in placing the second ligature; he applied it above the place of the bleeding, and a compress being laid upon the artery, every thing continued secure; by the third day the limb had quite recovered its natural warmth and feeling, and on the fourth, the dressings were moistened with a serous effusion, and the digestion of the wound was begun; but on the seventh day, there came on a considerable hæmorrhagy, and upon lifting the dressings, the ligature was found relaxed, so that it could not have the smallest effect upon the artery. The impossibility of drawing the loop of this ligature made Mr. Duschamps apply a second a little higher upon the artery. He found it very difficult to draw it tight enough to stop the blood, yet at last he did accomplish it; but the following evening it burst out again, the dressings were lifted, and the ligature was found a second time relaxed. In these circumstances, Mr. Duschamps resolved to prolong his incision, and tie the artery a little higher where it lies more superficially, he applied the ligature, and once more suppressed the bleeding with very great difficulty, for they were obliged to draw this third ligature fully as tight as either of the former. Still the blood rushed out from time to time the whole of that day and of the next, which was the tenth from the operation."

" These repeated hæmorrhagies having reduced the patient to extreme weakness, his pulse fluttering, and his face deadly pale, so many ligatures having failed successively, made Mr. Duschamps despair of saving him. It was now necessary, says Mr. Duschamps, to contrive some engine by which not only the artery might be compressed, but the ligature tightened from time to time in proportion to the fading of the parts; and now such operations became particularly difficult, for the parts were greatly swelled, so that the artery lay very deep."

He contrived an instrument of silver, with a flat button and a stalk; the stalk allowed the instrument to go down to the bottom of the wound, the flat button was to rest upon the artery as a smooth compress, and in the button were two slits through which the flat ligature surrounding the artery passed, the ends of the ligature being tied with a knot over the top of the stalk, and tightened as occasion required. Before the instrument could be made and prepared the artery had begun to bleed again, the dressings were then removed, the ligature was found quite slack, and was therefore cut away. There had been an occasional ligature laid under the artery higher up than the proper ligature, and that occasional ligature (ligature d'attente) now served for conducting a fresh tape under the artery; this tape was passed through the slits in the machine and tied over the top of the stalk, it suppressed the pulse in a moment, and from that time there happened no hæmorrhagy, and the man recovered.

Here there was no disease nor tendency to disease; the patient was a young and healthy man, wounded recently with the point of a pair of scissars. But the artery lay for ten days exposed and quite insulated, the bed of cellular substance which surrounds it quite destroyed, and the artery inflamed and ulcerating at the point where the first ligature was applied; this proves, that the applying ligature after ligature higher upon the artery, serves but to propagate the disease; in this case, each successive ligature as it was applied higher and higher along the artery made it ulcerate and burst anew; the machine which Mr. Duschamps calls his Serre-Artere, seems alone to have been effectual.

How little this method of Mr. Duschamps was founded on the true principles of surgery, I leave you to judge! how little it differed from the quill of Mr. Le Comte, the piece of sheet-lead of Mr. Persy, or the four ligatures of Messrs. Hunter, Home, Birch, Pott, and the other English surgeons. But I must explain to you how far it is from being secure.

The second occasion on which Mr. Duschamps used his Serre-Artere, was in a natural aneurism in one Jean Baptiste Gullimar, a hackney coachman in Paris, who, on the 14th of April, 1792, was laid in one of the beds of La Charité: he was of about thirty-four years of age, of a strong and vigorous constitution. It was about the end of September that he first observed, without being able to assign any cause for it, a small tumor growing in the ham; its increase was rapid; in the seventh month it was as big as an ostrich egg; the pulsation was not visible to the eye; he felt a stiffness in the ham, and a numbness in the whole limb, which was otherwise sound.

In making his incision in the fore part of the thigh, Mr. Duschamps very properly applied no tourniquet, being desirous of having the arteries in full pulsation that he might be aware of any danger. He had two small hooks, or flat handles of smooth white-iron with which his assistants held open the lips of the wound; but he did not dissect the artery clean, he seems to have left the sheath of the artery entire, and to have struck his needle through it. He took a large sharp aneurismal needle with an eye near the point, and pushed it through under the artery; but the first appearance of the point of the needle was attended with a gush of blood so sudden, as to alarm the assistants, who immediately concluded that the artery was wounded: the colour of the blood, however, and the manner in which it flowed, soon demonstrated that the hæmorrhagy proceeded from his having transfixed the crural vein.

The great needle now lay under the artery: Duschamps laid the point of his finger over the artery, and found that he could compress it betwixt his finger and the needle, so as to suppress the pulse in the aneurism, which even subsided somewhat in size while the artery was thus compressed. He therefore put the ligature through the eye of the needle, drew it back, and so laid his ligature double under the artery. "I chose," says Mr. Duschamps, "to lay this ligature exactly under the middle of that part of the artery which was naked, that I might have room, if occasion should require it, to tie another ligature above *." Now, it is this very precaution that is the ruin of all these operations. He took absolutely great pains to insulate the artery. "The ligature now put round the artery was next," says Mr. Duschamps, "held up like a bridle by one of the assistants, and pulled pretty strongly, by which I had an opportunity of disengaging it from the surrounding cellular substance above the ligature, which I did with the handle of my scalpel, and having thus freed the artery, I found it easy to pass the needle again, and as I withdrew it I laid an occasional ligature under the artery about half an inch above the first." Each of these ligatures was double; it was only the lower thread of the lowest ligature that was tied: of course there lay under the artery three relays of ligatures which could be of no use (unless the first gave way), and which could not be quite harmless; besides, he laid under the first ligature a piece of agaric upon the artery, and was forced to pull his first ligature so firm before the pulse ceased in the artery, that his assistant was afraid lest the artery should be cut across.

Such are the operations usually performed upon the femoral artery with every appearance of ingenuity and mechanical firmness, but with no attention to the state of living parts, to that process of inflammation and adhesion by which alone the artery is to be secured after these ligatures fall away. But this operation seems to have been wanting, even in that mechanical security; for the same evening, and no more

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* Page 306.

than seven hours after the straitening of the ligature, Mr. Duschamps thought he felt a pulsation, and he was not deceived. In truth, the ligature had never done its office, the limb had never lost its heat nor feeling, and the pulsation which he had perceived in the evening of the operation was very distinct the next day: "yet I did not," says Mr. Duschamps, "apprehend this to be unfavourable. I expected from the slightness of the pulsation, that there might pass along the main artery, just a sufficiency of blood for nourishing the limb, while there might be at the same time such a degree of pressure upon it, as to enlarge the inosculating arteries slowly." He resolved not to alarm himself. He left matters in this state for four days: but on the fourth morning he thought he could perceive the pulsation more sensibly, wherefore he resolved to draw the knot upon the lower circle of the occasional ligature. He was fearful of renewing the same degree of force which he had found it necessary to use in tying the first ligature upon the artery, and hesitated for some time whether to draw the common knot upon the ligature, or to draw the ligature through the slits of his instrument, his Serre-Artere. He found his ligatures embarrassed, he was obliged to cut the knot and use it only as a help to draw a new tape under the artery. This new tape was laid, the Serre-Artere was set upon the artery, with a piece of agaric betwixt it and the ligature, and the moment it was tied, the pulsation of the tumor ceased, the patient felt a deep and painful shooting in the whole limb, the foot was somewhat cold, though never insensible, and next morning the natural heat was restored, though the shooting continued for three or four days after this new ligature was applied.

But from the moment of placing this instrument upon the artery, Mr. Duschamps was as unhappy as if he had been conscious of all the fatal consequences of thus insulating the artery. "From day to day," says Mr. Duschamps, "I was in perpetual fear of the artery bursting" (attendent de jour à l'autre le rupture de l'artere). How could it fail to do so? there was still another occasional ligature lying festering under the artery, above the place where this machine and its ribbon were applied.

Mr. Duschamps had the prudence to keep every thing in readiness against any accident. The patient held incessantly a compress in his hand, ready to press upon the artery when it should burst. Mr. Duschamps knew too well from experience what was to happen. Two pupils watched alternately by the patient, and dressings, tapes, and another Serre-Artere were kept in readiness. On the ninth day, in the morning, Mr. Duschamps was informed that his patient, Gullimar, was losing blood. "I went instantly (says Duschamps,) though the second ligature, d'attente, which lay higher than that, which had just given way, kept me easy. The patient having instantly applied the compress I had given him, had lost little blood, and having every thing in order, I had but to wash the parts clean, get out the ends of this second ligature, and draw them through the slits in the button of the machine. This ligature was tied, a piece of agaric being first interposed, the ligature was drawn, the pulsation ceased, the blood stopped, and no accident happened from this time to the end of the cure. On the seventeenth day after, this ligature came away, and nine days after that, the patient left the hospital cured. The tumor," says Mr. Duschamps, "is disappearing, the man now follows his old profession safely, and we can observe one of the collaterals enlarging daily, and trace it easily by its pulsation along the side of the tumor*."

The dangers of these operations seemed to have touched Mr. Duschamps in a proper manner, and he adds a sentence which deserves notice. "But to speak honestly, this is a subject in which we have yet much to learn; our practice is still undecided, and without principle†."

It is for your sake, and that of humanity, that I criticise thus freely the practice of the greatest surgeons, who are really masters in their profession, and

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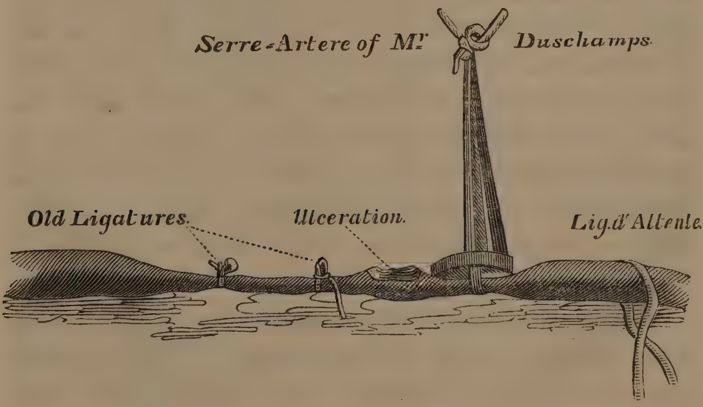
* A Drawing of the artery as it lay in this operation of Mr. Duschamps, demonstrating the danger of every such operation.



† "Mais si l'on est de bonne foi on conviendra que nous n'avons encore à ce sujet aucune connoissance bien determinée."

err only in particular points, or where the art itself is imperfect. The history of their operations, thus critically rehearsed, must be interesting to you, and must make you feel all the importance of the subject. You must take a lively interest in the condition of a patient who lies for ten days exposed to repeated hæmorrhages, the slightest of which, if he be already much reduced, may prove fatal. Each case, and each new method of tying the artery, brings along with it proofs of the imperfect state of this piece of surgery. You are now qualified to distinguish the faults of each operation. You see that there is a perpetual deviation from the simplest principles of pathology, and must be convinced that every process which insulates the artery exposes it to the danger of ulceration. You will perceive that it is the regular process of this ulceration that determines the bursting of the artery, which, as Mr. Duschamps himself observes, happens usually on the tenth or twelfth day. You will also perceive, that when such operations do succeed, it is only because the successive ligatures had destroyed the intercepted and insulated part of the artery, while the last ligature, that which holds the artery and saves the patient's life, is applied close to the sound parts: above all, you will be sensible that no operation can be more dangerous, more unsuccessful, than these, since they do not even satisfy the inventors.

In my first edition I proposed that parallel which both explains to us the imperfection of our present operations, and the method which we ought to pursue, in order to secure the artery of an aneurismal limb: "What, then, can be the difference betwixt this tying of the femoral artery in aneurism, that it should be so full of uncertainty and imminent danger, and the tying of the same artery in amputation, where the surgeon thinks the death of one patient by hæmorrhagy a flagrant disgrace?" The difference is merely, that in the operation of aneurism, the artery is held insulated and extended, and exposed to ulceration! while in the stump, after amputation, the artery being cut across, is allowed to shrink, and bury itself among the surrounding flesh, with which in due time it adheres, and is obliterated; and it is only by cutting the artery across in aneurism, and suffering it to bury itself among the surrounding parts, that it can be made equally secure with the artery in an amputated stump. This, which I formerly observed to be the oldest practice*, I am now to prove to you is the best; and the most instructive proof I can give you, after having explained the principles, is to relate from one of those old authors a successful case.

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* " I suspect it to be also a point of the very first importance to have the wounded artery sooner buried in granulations and in sound flesh; for though the healing of an artery depends always in part upon its own lively disposition to inflame and adhere, yet it must depend also in some degree on the support of surrounding parts. Bleeding from a tied artery seldom comes on till the fourth or fifth day; and if we could here, as in other great operations, lay the skin down and make it adhere before the sixth, or before the twelfth, or even before the twenty-sixth day (as my late observations explain to you,) we should have it all sound before the bleeding came on; but the surface is often large, the suppuration bad, the artery lies exposed, and may be dilated, or it may be even eroded by the foul pus. Birch says, it was where the great artery of the thigh seemed to have ulcerated, that his injection ran out. Home seems to attribute the death of his friend's patients to great suppuration formed round the bed of the artery; and certain it is, that Hunter succeeded better, when in some after cases he closed up the thigh immediately with stitches; for in one case he procured almost an immediate adhesion of the wound, and in a few weeks a perfect cure. Paree, Guy de Chauliac, and all the older surgeons, knew well the imporance of surrounding and supporting an artery, and burying it quickly under the granulations. The Arabians, in their operations for aneurism, first tied their ligatures, and then cut the artery across,

The celebrated Roman surgeon Joannes Trullius performed this operation in the following manner, related by Severinus, in his book De Medicina et Chirurgia Efficaci. " A young man of seventeen years of age was wounded with a ball in the left thigh, about eight inches from the groin. The ball entered betwixt the rectus and gracilis muscles on the fore part of the thigh, and passed out behind through the triceps. This wound was accompanied with a great laceration of parts, especially of the femoral artery, and with a profuse discharge of blood. Trullius, the celebrated surgeon and lithotomist, being called, found the wound already dressed by a barber. He left it untouched till next day, when, upon removing the bandages, he found the parts exceedingly swelled, and the tumor beating so as to raise the hand very powerfully when laid upon it. Trullius suspected a wound of the great artery, a case

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so that either end of the artery shrunk (surrounded by its own ligature) among the sound flesh, and was no more seen. But, independently of all authority, the reason of the thing instructs us not to keep our wounded artery, as some choose to do, open, that they may see it and tie it when it bursts out, but to bury it so among the rising flesh that it may never be seen, and that in a few days it may be safe from bursting."—*On the Nature and Cure of Wounds.*

That Wiseman, along with the older surgeons in England, were inclined to follow this method, is proved by the following passages. " The cure of an aneurisma consists in the timely application of proper medicaments, and bandage to restrain the blood and keep it within its channel; or by escharotics or the actual cautery you may destroy it. But if it lie where you may take it up, the cure is then best performed by dividing it."

altogether full of trouble and danger. He begged the friends to associate with him some skilful surgeon, and named Domferante, who, when he came, was as well as himself very fearful of the case.

Refrigerants and astringents were recommended; the patient was enjoined perfect quietness; and although occasionally the blood burst out to the amount of three or four ounces, it stopped spontaneously. The wound was left untouched for several days; but when at last the bandages were undone, the pulsation, pain, fever, and swelling, were all increased. The pulsation was particularly alarming; others were called into consultation; among so many there was naturally a variety of opinions, but the greater part advised "that this case should be left to time and nature." What could time or nature do but mature the aneurism, disorder the limb, bring the tumor on to bursting, and so endanger the life? Trullius alone was of a very different opinion; he advised that the tumor should be opened, with the design of seeking for the wounded artery.

His sensible advice was overruled; the dressings and rollers were applied anew; but on the seventeenth day, the blood bursting out again, Marcus Aurelius Severinus was called; and the consultation being met, all the history of the case was recited. The bandages were undone; they found the tumor free from inflammation, the pulsation less, and even the actual bulk of the aneurism diminished, as was affirmed, not only by the gentlemen met in consultation, but by all the attendants, and especially by the barber Hyeronimus, who was always present at the dressings, ready (with burning irons, I suppose,) to stop the blood.

"This fact being decisively proved, it was universally agreed that it would be imprudent to make any change in a line of conduct which seemed so successful. The same methods were pursued, only that attendants were appointed to watch perpetually, and that the patient was allowed more wine."

Thus did matters go on quietly till the thirtieth day, when the blood burst out again after the old manner, and again stopped of its own accord. The tumor was found suppurating, and suppuration being attended necessarily with the generation of flesh, it was still hoped that the artery would be healed, as it often happens. But we were deceived, says Severinus, for his strength daily declined, his body wasted, and his face was become hypocratic. We began to despair; nor had we, indeed, any chance of saving his life, but by dilating the wound, and either tying or burning the artery.

"The father of the young man was now called in among us, the dangerous situation of his son was honestly explained to him, and we submitted to him the sad alternative of a doubtful operation or certain death. The uncertainty of our very operation we were forced to acknowledge, since it was neither safe in the moment of execution (for some blood must be inevitably lost), nor even certain in its future success. He turned away from us sorrowful, and granting his consent only by his silence.

"The femoral artery was felt for in the groin; the tourniquet was applied; then the place of the incision was marked with ink. Trullius made the incision, and extracted fully six pounds of coagulated blood. This blood led towards the artery. The artery, thus exposed, was separated from its vein and nerve, and tied in two places, above and below the wounded part, and with the same precautions that are usual in tying varicose veins. The artery was divided by the ball more than one half across; the remaining half of the artery was cut across next day by Trullius, " lest it should contract before it putrified;" (" ne forsan partem antequam putresceret contraheret.") Perhaps I do no more than justice to Trullius in translating him in the following words: " The artery being thus divided by the ball, not merely through one half, but through two-thirds of its diameter, I next day cut it across, lest it should ulcerate before it closed; ne ante putresceret quam contraheret." If this was his meaning, he understood the doctrine as well as the practice; at all events, we have here a good precedent for what I have proposed: it is not the authority of Trullius nor Severinus that satisfies me, it is the fact thus distinctly related that gives a sort of assurance that this method will be generally successful. In all those cases which I have hitherto detailed, in proportion to the surgeon's ingenuity has been the patient's danger! in those cases where many ligatures have been used, where the artery has been made mechanically! firm, it has given way. In all the cases formerly mentioned the artery has burst out several times, and the patient was saved by a sort of accident; in this case alone, wherein the artery was thus simply tied and cut across, it continued perfectly secure. To those old authorities in favour of this practice, let me add that of my friend Mr. Abernethy, who has recommended this method, and who notwithstanding Mr. Blickes, ill success, continues still to recommend it, being supported against the impression of one unfortunate case, by a sensible and serious conviction of the principles upon which this improvement is founded*.

RECAPITULATION.

We are now come to that period of this discourse in which you should begin to inquire what you have learned, and I should, on my part, recapitulate those conclusions which have the most direct relation to practice.

1. You must be satisfied, then, that an artery may be actually burst by violence, and yet form its aneurisms very slowly; even the largest arteries of the body, after they are burst, are supported in some degree by that firm sheath of cellular substance which makes a part as it were of every artery.

2. You must have observed that it is this strong sheath that forms the coat of each aneurism; and

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* Mr. Abernethy thought Mr. John Bell took this idea from him, and that all this authority of old masters was but to cover the deceit. In this he was mistaken; and it should make us humble to see that both Mr. J. Bell and Mr. J. Abernethy were wrong; experience having since proved that the operation is performed with most security, when only one ligature is employed, and consequently where the artery can not be cut across.

But the principles laid down in this division of the work stand good, the perfection of the operation for aneurism being the application of a ligature to the artery with the least possible injury or disturbance of the surrounding parts. C. B.

you may with some degree of truth use this contradiction of terms, "that every diffused aneurism is encysted." The cyst of each aneurism is formed of the sheath of the artery, supported by the surrounding cellular substance, which is condensed often into a bag so firm, and so connected with the artery, that aneurism from wounds, and more especially aneurism from bursting of the arterial coats, may resemble a natural aneurism, and its sac be mistaken, especially in coarse dissections, for a dilatation of the artery itself.

3. You will see that it is in consequence of this kind of support that the greatest arteries of the body, the femoral artery, the popliteal artery, and even the aorta itself, form their aneurisms so very slowly. You will observe the sac all on one side covering and pressing upon the artery, which shows it to be not a natural, uniform, and general dilatation of all the arterial coats, but a partial yielding of the artery; and when you recollect how easily an artery may be injured, when you observe also that the strain of the muscles which tears the great Achillis tendon, cannot but have very dangerous effects on an artery, you will be attentive to symptoms of which others would think lightly; you will be able to trace the affection to its true cause, and be aware of its nature early; you will foresee the dangerous consequences of delay, and be prepared both to give a decisive opinion, and to adopt active measures proportioned to the real dangers of the case. You know how dangerous it is to consider pulsation as the inseparable sign of aneurism, how often the pulsation ceases in the latter

stage of the disease, and you know that of all tumors, aneurism is most destructive to the bones, joints, and surrounding soft parts, and should, least of all, be allowed to grow to any dangerous size.

4. You must be sensible, that while aneurism increases in size, it gradually oppresses the main artery of the limb more and more; the inosculations enlarge, and the change of circulation which we attribute solely to our operations, is in a great degree the work of nature. The limb on which we operate for aneurism can never be endangered by want of blood; all the dangers of the operation arise rather from the intense action of the lesser arteries of the limb; this is the reason why a large incision falls into gangrene; such a state of the limb is equivalent to the high inflammation of a fractured limb.

5. You are well aware of the danger of performing any operation in the ham itself. The cavity is narrow, the parts compressed, the bones and joint easily affected, the artery not easily found. If you seek the artery there, your incision must be large, and a large incision, combined with the turgid state of the limb, will bring on high inflammation, followed by gangrene*. The incision must be deep, and as the inosculating arteries cannot escape, if in your operation you cut but a few of them, you will have a secondary hæmorrhagy from channels which you cannot command! if you cut many of those inosculations which at the moment of your tying the main artery should

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* I would have written the sentence thus, "and a large incision will bring on inflammation and turgidity, then the activity of the vessels will be abated by compression, and gangrene will follow."

support the limb, it may fall into direct gangrene from a total want of blood, not preceded by increased heat and inflammation of the wound, but by coldness in the lower part of the limb.

6. You know that all that is required towards completing the natural process, and turning the tide of blood upon the inosculating arteries, is to tie the main artery, and that by performing this operation on the fore part of the limb, you cut no inosculations, you expose no bones, and you have no difficulty in finding the artery. You have no temptation to strike in your needles clumsily, nor to put your ligatures coarsely about arteries, veins, nerves, and all! so as to make the ligatures loosen from the parts very slowly. You have it in your power to open the proper sheath in which the artery is enclosed, and to separate it deliberately from the vein.

7. You are well aware, that after all that has been said of gangrene, few have died of it! that many have died of hæmorrhagy from the bursting of the artery! that this bursting of the artery proceeds from ulceration of it, which is the reason why it bursts usually about the tenth or twelfth day. You must be satisfied that every mechanical contrivance for securing the artery insulates it; that every artery by being insulated and held off from uniting with the parts which should support it must ulcerate. You will, I doubt not, assent to that conclusion which I have deduced from innumerable facts, "That the more of mechanical ingenuity appears in any operation of this kind, the farther has the operator departed from the

true principles of surgery;"—that the surrounding of an artery with four ligatures, with split quills, with plates of lead, with pieces of bend leather, with compresses of agaric, cork, &c. is as inconsistent with the process of adhesion, which must precede the cure.

THE END.

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